

FILE 6071

HOUSATONIC RIVER FLOOD CONTROL

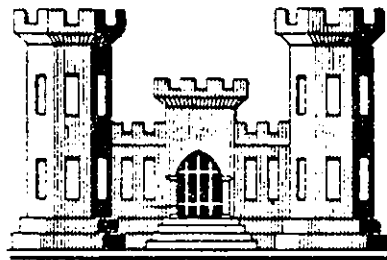
HOP BROOK

DAM & RESERVOIR

HOP BROOK, CONNECTICUT

DESIGN MEMORANDUM NO. 3

GENERAL DESIGN



U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.

MARCH 1964

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO.

27 March 1964

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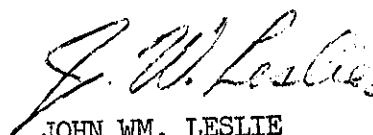
SUBJECT: Hop Brook Dam and Reservoir - Hop Brook - Housatonic
River Basin, Connecticut - Design Memorandum No. 3 -
General Design

TO: Chief of Engineers
ATTN: ENG CW-E
Washington, D. C.

In accordance with EM 1110-2-1150, there is submitted,
for your review and approval, Design Memorandum No. 3 - General
Design for the Hop Brook Dam and Reservoir - Hop Brook - Housa-
tonic River Basin, Connecticut.

FOR THE DIVISION ENGINEER:

Incl (10 cys)
Des Memo No. 3



JOHN WM. LESLIE
Chief, Engineering Division

FLOOD CONTROL PROJECT
HOP BROOK DAM AND RESERVOIR

HOP BROOK

HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDA INDEX

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4	Real Estate		
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6	Concrete Materials	31 Jan 1964	19 Feb 1964
7	Embankments & Foundations		
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9A	Reservoir Development (Master Plan)		
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HOP BROOK DAM AND RESERVOIR

HOP BROOK

HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 3
GENERAL DESIGN MEMORANDUM

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2-1 to 2-6	Letter, U. S. Department of Health, Education and Welfare, dated November 7 1963 and Evaluation Report, dated January 30, 1957
3-1 to 3-12	Letter, U. S. Fish and Wildlife Service, dated November 22, 1963 and Report, dated April 25, 1960
4	Letter, State of Connecticut, Water Resources Commission, dated February 27, 1964
5	Letter, Bureau of Public Roads, dated May 7, 1963

HOP BROOK DAM AND RESERVOIR
HOP BROOK
HOUSATONIC RIVER BASIN
CONNECTICUT

A. PERTINENT DATA

1. Purpose Flood Control

2. Location of Dam

State	Connecticut
County	New Haven
Towns	(City) Waterbury & Naugatuck
River	Hop Brook

Distance above:

Confluence Hop Brook and Naugatuck River	1.4 miles
Confluence Naugatuck and Housatonic Rivers	16 miles
New Haven, Connecticut	17 air miles, southeast
Torrington, Connecticut	20 air miles, north
Hartford, Connecticut	27 air miles, northeast

3. Drainage Areas

Hop Brook at Damsite	16.4 square miles
Hop Brook at Mouth, confluence with Naugatuck River	17 square miles
Naugatuck River at Mouth, confluence with Housatonic River	312 square miles

4. Streamflow

Record of USGS Gaging Station on Leadmine Brook near Thomaston, (Drainage Area = 24.0 square miles) October 1931 to September 1959.

<u>Time</u>	<u>c.f.s.</u>	<u>c.f.s./square miles</u>
Average Annual (28 years)	48.6	2.03
Maximum Year (1956)	73.0	3.04
Minimum Year (1932)	24.2	1.01
Maximum Month (March 1936)	268	11.17
Minimum Month (August 1949)	0.7	0.03
Maximum Day (19 Aug 1955)	3,660	152.50
Minimum Day (26 Jun 1949)	0.1	0.004

5. Maximum Floods of Record

Record of USGS Gaging Station on Leadmine Brook near Thomaston, Connecticut.

<u>Time</u>	<u>Peak Discharge</u>	
	<u>c.f.s.</u>	<u>c.f.s./square miles</u>
August 1955	10,400	433
December 1948	5,150	214
October 1955	3,100	129
September 1936	3,050	127

6. Criteria for Spillway Design Flood

Peak inflow, full reservoir, cfs	26,400
Total volume of rainfall, inches	25.0
Infiltration rate, inches per hour	0.05
Total volume of runoff, acre-feet	21,775
Total volume of runoff, inches	23.8
Duration of storm, hours	24
Reservoir stage at start of flood, ft., msl	357.2
Gates	Open

7. Reservoir Elevation, Areas and Capacities

<u>Location</u>	<u>Elevations ft, msl</u>	<u>Area Acres</u>	<u>Acre Feet</u>	<u>Inches On Drainage Area</u>
Permanent Pool	310	21	120	0.14
Spillway Crest	364	270	6,970	8.00
Flood Control Storage	310-364	270	6,850	7.86
Maximum Surcharge	376	371	10,756	12.35

8. Dam and Appurtenant Structures

a. Dam
Type

	Rolled earth fill with rock slope protection
Top Elevation, ft., msl	381.0
Top Width, feet	25.
Maximum base width, feet	560.
Maximum height, feet	97.
Length, feet	520.
Slope, upstream above El. 364.0	1 on 2.5
Slope, upstream below El. 364.0	1 on 3
Berm, at El. 319.0	
Slope, upstream below El. 319.0	1 on 2.5
Slope, downstream	1 on 2.5
Freeboard above spillway design flood height, feet	5

b. Dike
Type

Top elevation, feet, msl
Top width, feet
Maximum base width, feet
Maximum height, feet
Length, feet
Slope, upstream
Slope, downstream
Freeboard above spillway design
flood height, feet

Roller earth fill with
rock slope protection
381.0
15.
185.
33.
404.
1 on 2.5
1 on 2.5
5

c. Spillway
Type

Crest length, feet
Crest elevation, feet, msl
Maximum head, feet
Spillway design discharge, cfs

Uncontrolled, concrete
overflow, chute channel
200.
364.
12.
23,400

d. Outlet Works
Type

Size of Conduit
Length of conduit, portal to
portal, length, feet
Weir for permanent pool with
stoplogs, operating elevations,
feet, msl
Conduit invert elevation, feet, msl
Number of Gates
Size of Gates
Type of Gates
Elevation gate sill, feet, msl
Capacity discharge of outlet,
reservoir at spillway crest, cfs

Upstream intake tower -
dry well type and re-
inforced concrete square-
shaped cut-and-cover con-
duit
3'-0" x 5'-0"
425
308 to 312
292
2
3'-0" x 4'-0"
Hydraulic Sluice
292

1 Gate

560

2 Gates

610

9. Real Estate

a. Fee Acquisition
(1) Land

<u>Classification</u>	<u>Area, acres</u>
Commercial	5
Residential	21
Developable	277
Rear Land	200
Roads and Water	<u>22</u>
Total Land	525

(2) Improvements

<u>Classification</u>	<u>Area, acres</u>
Residences	42
Commercial	2
Fish & Game Club Building	<u>1</u>
Total Improvements	45

10. Relocations

	<u>Existing Mileage</u>	<u>Proposed Mileage</u>
a. <u>Roads</u>		
Highways	2.2	2.6
b. <u>Utilities</u>		
Electric Transmission Lines	1.9 (est)	1.9 (est)
Electric Transmission Lines	.4 (est)	.4 (est)
Telephone Exchange Lines	1.5 (est)	1.5 (est)

11. Principal Quantities

Common Excavation, General	250,000 c.y.
Common Excavation, Borrow	65,000 c.y.
Rock Excavation, Open Cut	46,000 c.y.
Rolled Earth Embankment	209,000 c.y.
Gravel Bedding and Gravel Fill	30,000 c.y.
Rockfill & Rock Slope Protection	27,500 c.y.
Concrete	3,070 c.y.
Cement	5,000 bbl.
Steel Reinforcement	275,000 lbs.

107.0
209.0
21.0
264.5

12. Estimated Project Cost (1964 Price Level)

	<u>Cost</u>
Lands and Damages	\$1,415,000
Relocations	1,610,000
Reservoir	15,000
Dam and Appurtenant Structures	1,130,000
Recreation Facilities	50,000
Buildings, Grounds, and Utilities	52,000
Permanent Operating Equipment	20,000
Engineering and Design	308,000
Supervision and Administration	<u>200,000</u>

Total Estimated Project Cost \$4,800,000

FLOOD CONTROL PROJECT

HOP BROOK DAM AND RESERVOIR
HOP BROOK
HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 3
GENERAL DESIGN MEMORANDUM

MARCH 1964

B. INTRODUCTION

1. Purpose. - This memorandum furnishes information and presents the general plan for the Hop Brook flood control dam and reservoir project. It is intended to facilitate the preparation and review of detailed design memoranda, plans and specifications.

2. Scope. - This memorandum presents general data for the entire project, including costs and benefits. The data contained herein will be supplemented and expanded, as required, by supplement to this memorandum and by subsequent design memoranda.

C. PROJECT AUTHORIZATION

3. Authorization. - The Hop Brook Project was authorized by the Flood Control Act approved July 14, 1960, Public Law 86-645, which reads in part as follows:

"The project for the flood control dams and reservoirs on the Naugatuck River, Connecticut, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 372, Eighty-sixth Congress, at an estimated cost of \$10,230,000."

4. Chief of Engineers Recommendations. - In House Document No. 372, 86th Congress, 2nd Session, the Chief of Engineers recommended ". . . the improvement of Naugatuck River by the construction of four reservoirs for flood control on Northfield Brook, Branch Brook, Hancock Brook, and Hop Brook, at an estimated cost, all Federal, of \$10,230,000 for construction and \$30,000 annually for maintenance and operation. The work would be subject only to the requirements that local interests give assurances that they will establish encroachment lines downstream of the recommended dams to permit reasonable, efficient reservoir operations."

D. INVESTIGATIONS

5. Latest Interim Report. - The interim report on review of survey for flood control, Housatonic River Basin, Naugatuck River, Connecticut, dated 30 June 1958, contains the report on the Hop Brook Dam and Reservoir. The report was published without appendices, except letters of comment, in House Document No. 372, 86th Congress, 2nd Session. The preparation of the report was authorized by resolution of the Committee on Public Works of the United States Senate on September 14, 1955 and the House of Representatives on June 13, 1956. The report recommends that the authorized plans for flood control in the Housatonic River Basin be modified to provide for construction of flood control dams and reservoirs on Northfield Brook, Branch Brook, Hancock Brook and Hop Brook. Further, the report provided for construction of a flood control reservoir on Hop Brook of 6,840 acre-feet capacity equivalent to 8.0 inches of runoff from its net drainage area of 16.0 square miles. The site is in the City of Waterbury and the Town of Naugatuck, about 1.4 miles upstream of the confluence of Hop Brook and Naugatuck River.

6. Prior Reports. - Flood control in the Naugatuck River and its tributaries has been considered in the following published reports on the Housatonic River:

a. "308" Report. - A report dated June 25, 1931 and printed as House Document No. 246, 72nd Congress, 1st Session, included navigation, water power, flood control and irrigation in the Housatonic River Basin. The report found that further improvements were not warranted at that time.

b. 1940 Report. - A report dated June 20, 1940 and printed as House Document No. 338, 77th Congress, 1st Session, recommended construction of the Thomaston Dam on the Naugatuck River above Thomaston, Connecticut. This project was authorized by Public Law 534, 78th Congress, 2nd Session, approved December 22, 1944.

c. 1956 Report. - An interim report dated May 31, 1956, and printed as House Document No. 81, 85th Congress, 1st Session, covered flood control on the Upper Naugatuck River above Torrington, Connecticut, and recommended the construction of the Hall Meadow Brook Reservoir and the East Branch Reservoir. These projects were authorized by Public Law 500, 85th Congress, approved July 3, 1958.

7. Reports of Other Agencies. -

a. NENYIAC Report. - Flood control and allied water uses are also considered in Part 2, Chapter XXII, "Housatonic River Basin"

of "The Resources of the New England-New York Region". This comprehensive report inventoried the resources of the New England-New York area and recommended a master plan to be used as a guide for the regional planning, development, conservation, and use of land, water and related resources of the region. Also included were proposals to reduce flood losses. Prepared by the New England-New York Interagency Committee, the report was submitted to the President of the United States by the Secretary of the Army on April 27, 1956. Part 1 and Chapter 1 of Part 2 are printed as Senate Document No. 14, 85th Congress, 1st Session.

b. Naugatuck Valley River Control Commission. - The Naugatuck Valley River Control Commission has issued an Interim Report on the problem of flood control on the Naugatuck River and tributaries dated March 1956. Various other reports have also been prepared by Town and State agencies.

8. Current Investigations. - Studies for the project plan utilized the basic data obtained for the previous investigations. In addition, the following new data were obtained and studies made:

a. New photogrammetric maps of the reservoir area were obtained and new area-capacity curves computed. A new large-scale topographic survey map of the dam site was prepared.

b. All available subsurface information has been reviewed and the geological and soils investigations of foundation conditions and embankment materials are being completed.

c. Hydrologic studies have been reviewed and new studies have been made to determine the reservoir capacity, the spillway design flood and outlet requirements. The Design Memorandum on Hydrology was prepared and submitted to the Chief of Engineers on 31 January 1964 and was approved as a basis for future planning on 19 February 1964.

d. New preliminary appraisals of lands and damages to improvements in the reservoir, work and borrow areas have been completed and are reported in Section N of this Memorandum.

e. Relocation of roads within the reservoir area is being discussed with State and Town officials. Preliminary studies of the affected roads have been made.

f. Relocations of utilities have been discussed with the owners and preliminary studies have been prepared.

9. Coordination with Other Federal and Non-Federal Agencies. -

a. Federal Power Commission. - During the preparation of the interim report of June 1958, the Federal Power Commission reviewed the power potentialities of the Hop Brook Dam and concluded that the multiple-purpose development of the Hop Brook site for power and flood control was not economically feasible. The views of the Federal Power Commission were confirmed in letter dated May 24, 1963 which is included as Exhibit No. 1 of this Memorandum.

b. U. S. Department of Health, Education and Welfare. - A previous report entitled "Preliminary Evaluation Report on Vector Problems Related to Proposed Housatonic River Flood Control Project in Connecticut", forwarded by letter dated January 30, 1957, was confirmed by letter, dated November 7, 1963. Copies of this letter and the report are included as Exhibit No. 2-1 of this Memorandum.

c. U. S. Fish and Wildlife Service. - The Acting Chief, Division of Technical Services of the U. S. Fish and Wildlife Service, in letter dated November 27, 1963, Exhibit No. 3-1 of this Memorandum, indicates that the letter report from the Regional Director of the U. S. Fish and Wildlife Service, dated 25 April 1960, Exhibit No. 3-3 of this Memorandum is still valid except for paragraph 7 of the letter report. The report is the result of an investigation of the effect of the project upon fish and wildlife resources of the area.

d. State of Connecticut, Board of Fisheries and Game. - The report on fish and wildlife of the Hop Brook Reservoir prepared by the U. S. Fish and Wildlife Service was indorsed by Connecticut State Board of Fisheries and Game. See Exhibit No. 3-12 of this Memorandum.

e. State of Connecticut, Water Resources Commission. - The authorizing document for the Hop Brook Dam and Reservoir requires that construction be contingent upon the zoning of the river channel downstream of the dam. In the letter of 27 February 1964, the Director, State of Connecticut Water Resources Commission, advises that zoning will be completed before the dam is completed. See Exhibit No. 4 of this Memorandum. The Director further states that there was one possible need or desire to have water supply storage included in this reservoir. The Naugatuck Division of the Connecticut Water Company indicated an interest and desired an opportunity to consider the inclusion of water supply. After discussion with the Naugatuck Division, they felt that the cost of pumping from such a low elevation into their system, the cost of treatment due to heavy pollution above the dam, and the fact that large land areas may be flooded only to a shallow depth imposed many uncertainties. Therefore, it was not considered justified to

make any major contributions toward the construction of the Hop Brook Dam for possible future water storage. See Exhibit No. 4 of this Memorandum.

f. U. S. Department of Commerce, Bureau of Public Roads. - In accordance with the provisions of Public Law 562, the Bureau of Public Roads was requested to ascertain whether the proposed Hop Brook Dam was needed or desired to serve as a public highway bridge. In letter dated 7 May 1963, the Bureau advised that no public highway bridge is economically desired or needed on this dam at this time. Letter dated 7 May 1963 is included as Exhibit No. 5 of this Memorandum.

10. Public Hearings. - A public hearing was held on 11 December 1956 in Waterbury, Connecticut, to determine the need for additional projects for flood control and allied purposes on the Naugatuck River, Housatonic River Basin, Connecticut. Improvements requested by the Naugatuck Valley River Control Commission and representatives of Federal, State and municipal governments included flood control dams and reservoirs and various local improvements. At this hearing, public sentiment was opposed to the construction of the dam. Opposition was expressed by the Town of Middlebury, a community organization and local property owners.

E. LOCAL COOPERATION

11. Local Cooperation. - The Act which authorizes the Hop Brook Flood Control Project does not require local cooperation in connection with its construction. All construction costs of the project would be met with funds of the United States. Local cooperation is, however, required to the extent that the channel through the downstream damage areas be zoned to prevent further encroachment and to prevent the replacement of obstructive or hazardous structures along the channel whenever they become obsolete. The State of Connecticut has established such encroachment lines on the main stem of the Naugatuck River.

F. LOCATION OF PROJECT AND TRIBUTARY AREA

12. Location of Project. - The Hop Brook Reservoir Project is located in the City of Waterbury and the Towns of Middlebury and Naugatuck, Connecticut. The dam site is located on the Hop Brook about 1.4 miles above its confluence with the Naugatuck River. The reservoir will extend upstream along the Hop Brook about 1.5 miles. The total drainage area of the Hop Brook is 17 square miles and the drainage area at the dam site is 16.4 square miles. See Basin Map, Plate No. 3-2 and Reservoir Map, Plate No. 3-3.

13. Description of the Naugatuck River Basin. - The Naugatuck River, principal tributary of the Housatonic, is a rapidly flowing, non-navigable stream. The watershed, which lies wholly within the western part of Connecticut, is about 50 miles long with a maximum width of 12 miles and a total drainage area of 312 square miles. The drainage area at Torrington is about 50 square miles. The headwaters of the Naugatuck lie about 6 miles south of the Massachusetts line in the southeast corner of the Town of Norfolk at an elevation of about 1,500 feet. Between the headwaters and Torrington, the rivers fall approximately 900 feet in about 13 miles. The general direction of flow is southerly, through Torrington, Thomaston, Waterbury, Naugatuck, Beacon Falls, Seymour, and Ansonia to Derby, where the Naugatuck joins the Housatonic in its tidal reach about 12.25 miles from Long Island Sound.

The Naugatuck River is formed in the City of Torrington by the confluence of its West and East Branches. The river is fed by relatively small steeply falling brooks. The other principal tributaries are Leadmine Brook, Branch Brook, Steel Brook, Hancock Brook, Mad River, Hop Brook, Bladens River, Northfield Brook and Little River. See Naugatuck River Watershed, Plate No. 3-1.

G. RECOMMENDED PROJECT PLAN

14. Recommended Project Plan. - The recommended project plan provides for an earth and rock fill dam 500 feet long and 97 feet in height above stream bed. A remote chute spillway with a 200-foot broad-crested concrete weir will be located in a saddle about 1200 feet northeast of the left abutment of the dam. To contain the discharge within the spillway, a dike will be required at the left side of the channel. The dike will be 404 feet long with a maximum height of 33 feet above the ground elevation. The outlet works will consist of a 3-foot by 5 foot cut-and-cover concrete conduit founded on rock in the left abutment of the dam.

The Connecticut State Route 63, a bituminous surface state road on the right bank of the river valley in the reservoir will require relocating and raising above the guide-taking line, a total of about 1.8 miles. Roads feeding into Route 63 will be raised to meet the new grades on Route 63. The Bristol Street Road and bridge in the reservoir area will be abandoned and traffic will be rerouted thru existing roads which will require improvements.

Electric and telephone lines will be relocated along the relocated roads.

The structures, improvements and relocations are described in detail in Section K, Description of Proposed Structures and Improvements. The various structures and topography at the site, and proposed alignments of road relocations are shown on Plate Nos. 3-3 and 3-4.

H. DEPARTURE FROM PROJECT DOCUMENT PLAN

15. Project Document Plan. - The Hop Brook Project was authorized under the Flood Control Act of 14 July 1960 in general accordance with the plan presented in House Document No. 372, 86th Congress, 2nd Session. This plan proposed flood control storage of 6,840 acre-feet, equivalent to 8.0 inches of runoff from the tributary drainage area of 16.4 square miles. From the available U.S.G.S. quadrangle sheets, this capacity set the spillway crest elevation at 362 feet, mean sea level.

16. Departure from Project Document Plan. - The following modifications and changes from the approved document plan have been made during the development of detailed studies based on additional investigations and information obtained.

a. The area-capacity curves developed from the new photogrammetric maps of the reservoir indicated that to obtain the authorized storage of 8 inches, the spillway crest elevation would have to be at elevation 364.0 feet, mean sea level. See Area-Capacity Curves, Plate No. 3-11. + 2'

b. The top elevation of the dam has been raised from elevation 377.0 to 381.0 mean sea level, due to the spillway modifications described below. + 4'

c. Results of economic studies based on a 230-foot wide channel spillway with an 8-foot surcharge versus a 200-foot broad-crested remote spillway with a 12-foot surcharge in the vicinity of the dike indicated that the remote spillway should be adopted. A 10-foot wide by 2-foot deep pilot channel will be provided at the end of the spillway discharge channel for surface drainage and small spillway discharges. + 4'

d. The conduit has been changed from a 4-foot diameter reinforced concrete pipe encased in concrete founded on rock to a 3'-0" by 5'-0" rectangular cast-in-place reinforced concrete section founded on rock.

e. Results of embankment design have indicated that the upstream and downstream slopes of the dam would have to be flattened. The embankments have been modified to fully utilize all available materials from required excavation and from nearby available borrow areas.

f. An access berm has been added on the upstream face of the dam to permit passage of wheeled vehicles to the intake structure for maintenance and debris clearing operations.

I. HYDROLOGY

17. Spillway Design Flood. - The spillway design flood was computed by applying rainfall excess resulting from probable maximum precipitation to an adopted two-hour unit hydrograph. The total rainfall amounted to 25 inches in 24 hours with 19.8 inches occurring in a six-hour period. Losses were assumed at a rate of 0.05 inches per hour, resulting in rainfall excess of 23.8 inches. The flood hydrograph with a peak inflow of 26,400 c.f.s. was routed through the reservoir storage assuming an initial six inches of runoff in the reservoir and the outlet operative. For the tentatively selected spillway length of 200 feet, the spillway outflow would be 23,000 c.f.s. and the surcharge 12.0 feet.

18. Channel Capacity. - The channel capacity of Hop Brook downstream of the dam is estimated to be 400 c.f.s.

19. Flood Control Outlet. - The selected outlet for Hop Brook will consist of a 3' x 5' conduit and two 3' x 4' gates. With the reservoir about 20 percent full, the discharge through the conduit will be about 400 c.f.s. The capacity will allow emptying of the reservoir from full pool in about 12 days and also will satisfy diversion requirements.

20. Freeboard. - A freeboard of 5.0 feet above the maximum surcharge pool elevation of 576.0 is provided resulting in a top elevation of dam of 581.0 feet, mean sea level.

21. Reservoir Capacity. - Prior to 1955, it was considered that there should be sufficient storage capacity in a flood control reservoir to hold 6 inches of run-off from the watershed upstream of the project. Following the major floods of 1955, a reappraisal was made of storage requirements in flood control reservoirs in New England. In general, the volume of run-off experienced in the 1955 floods had demonstrated that it is desirable to provide at least 8 inches whenever feasible. On this basis, the Hop Brook project was recommended for authorization as an 8-inch flood control reservoir. Prior to final authorization, the storage was modified to provide for a small permanent pool to mitigate fish and wildlife losses, thereby giving 7.86 inches of flood control storage.

J. GEOLOGY

22. General. - The project site is located in the western Connecticut highlands, an area of plateau remnants sloping gently to the southeast. The area is of moderate topographic relief, largely controlled by pre-Triassic metamorphic rocks and modified by glacial erosion and deposition.

23. Description of Site. - Hop Brook, at the dam site, flows in a narrow, heavily-wooded, rock-controlled divide. The stream bed and the right abutment of the dam is strewn with large boulders and blocks with the only extensive bedrock exposures occurring slightly above the stream bed at the downstream toe of the proposed embankment. (See Plate No. 3-8). On the left abutment, extensive exposures of bedrock occur at stream grade and at higher elevations above the height of dam.

The spillway and dike structures are located in a saddle approximately 1,000 feet northeast of the dam site. (See Plate No. 3-9). Bedrock is exposed at the saddle in an abandoned railroad cut where it intersects the northerly edge of a rock spine forming the left abutment of the proposed spillway weir.

24. Overburden. - A sandy glacial till deposit containing numerous cobbles and boulders overlies the bedrock surface to thicknesses of 5 to 10 feet and at intermittent locations on the abutments. (See Plate No. 3-10). Glacial outwash deposits of sands, gravels and large boulders generally overlay the till and in some areas extend to the bedrock surface.

In the spillway and dike area, the overburden is similar in composition and in sequence of deposition to those at the dam-site. The outwash deposits are thin in the spillway approach channel, generally less than 5 feet, but increase in thickness to 15 feet in the spillway discharge channel. The till mantles the rock surface and is thickest along the right side of the spillway approach channel.

The overburden in the dike area is assumed to be glacial till with a surficial layer of large boulders and blocks. The thickness of overburden increases from rock exposure at the south abutment to 10 feet or more along the north abutment.

25. Bedrock. - Bedrock at the site as observed in cores and outcrops is generally granitized schist and gneiss displaying a variety of degrees of metamorphism jointing and weathering. The quality of the rock within the limits of excavation at the damsite is generally poor, being highly fractured and weathered to depths in excess of 10 feet below the rock surface. Based on the condition of the rock at the damsite, it is planned to obtain major portions of the rock to be utilized in the embankment from the spillway excavations where the rock is more massive and less weathered. The layout and design of the outlet works has been made with recognition of rock conditions. The generally weathered and open condition of the upper rock zone as revealed by borings

and pressure testing will require extensive grouting to minimize seepage. More detailed discussion of the geology and foundation conditions will be presented in Design Memorandum No. 2 - Site Geology, and Design Memorandum No. 7 - Embankments and Foundations.

K. DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

26. General. - A description of each of the principal elements of the proposed plan of improvement for the Hop Brook Reservoir Project is presented in the following paragraphs. Studies to develop design details for each element are under way and will be presented in subsequent Design Memoranda.

27. Dam. - The project plan provides for the construction of a rolled earth fill dam with upstream and downstream rock slope protection approximately 520 feet long with a maximum height of about 97 feet above the stream bed. The top width of the dam will be 25 feet with an 18-foot wide paved roadway. Access to the top of the dam will be by an access road from the relocated road on the west abutment. The top elevation of the dam will be 381.0 mean sea level providing 12.0 feet of spillway surcharge and 5.0 feet of freeboard.

On the basis of the foundation conditions, the availability and characteristics of borrow and required excavation material, and the utilization of materials from the required excavations, the dam embankment section will be of the zoned type and will include an upstream inclined impervious fill zone, a large random fill zone, a pervious internal wick drain and drainage blanket, a small downstream rock toe, rock slope protection and gravel bedding. The locations, compositions and dimensions of the zones will be firmly established at a later date on the basis of the availability and characteristics of the various types of embankment materials as determined by investigations now in progress. The embankment slopes, on the basis of experience with other designs using similar materials, have been tentatively established upstream at 1 on 2.5 above the spillway crest (elevation 364.0 m.s.l.), 1 on 3 below the spillway crest to a 12-foot berm at Elevation 319.0 m.s.l. and 1 on 2.5 below Elevation 319.0. The 12-foot berm will provide access to the intake structure. The downstream embankment slope will be 1 on 2.5. Seepage through the embankment will be controlled by the arrangement of zones of materials with different permeabilities. Seepage through the embankment foundation will be controlled by an impervious foundation cut-off to bedrock, a continuous grout curtain in the bedrock, a pervious drainage blanket, and a downstream rockfill toe. Both the drainage blanket and the rockfill toe will be in contact with the bedrock surface over most of the downstream portion of

the embankment. The above-described embankment section is considered to be tentative pending completion of all subsurface investigations and embankment design studies. For embankment plan, profile of the dam and a tentative embankment section, see Plate Nos. 3-4 and 3-5.

28. Dike. - A rolled earth fill dike approximately 404 feet long with a maximum height of about 33 feet will be constructed on the left bank of the remote spillway. The top width will be 15 feet. The dike embankment will be of the homogeneous type except for a small landside rockfill toe and will be constructed principally of suitable random fill material from required excavations. The outer slopes will be 1 on 2.5. The profile of the dike and a tentative embankment section are shown on Plate No. 3-5.

29. Spillway. - The spillway will be chute type located 1,200 feet northeast of the dam through a saddle. For details, see Plate Nos. 3-4 and 3-6. The weir will be a concrete broad crested section founded on rock at the high point of the channel. The length of the weir will be 200 feet at spillway crest elevation 364.0 feet, mean sea level. The height of the concrete weir above the spillway approach will be 2 feet, making the maximum elevation of the approach channel 362.0 feet, mean sea level, at the upstream face of the spillway weir. The excavated approach channel will slope down into the reservoir at a 1.0 percent grade for drainage. The spillway chute or discharge channel excavated in earth and rock will be about 1,200 feet. It will slope down from invert elevation 362.0 at the weir to invert elevation 332.0, in 600 feet, and thence to invert elevation 310.0 in 600 feet at which point it will flow freely for a distance of about 365 feet toward the brook. The discharge channel width will vary from 200 feet at the weir to 80 feet in a distance of 300 feet. The 80-foot channel width will be maintained for the remaining distance of 900 feet. A 10-foot wide by 2-foot deep pilot channel will be provided in the discharge channel. The total length of the excavated channel will be about 2,500 feet and the bottom slope will vary from a minimum of 1.0 percent to a maximum of 5.0 percent. Excavated materials from the spillway will be used in the dam and dike embankments to the greatest extent possible.

30. Outlet Works. - The outlet works will be located on the left bank under the dam and will consist of intake channel, an intake tower, a conduit on rock under the dam, a stilling basin and an outlet channel. Details of the outlet works are shown on Plate No. 3-7.

a. Intake Channel. - The 14-foot wide and 105-foot long intake channel will be excavated partly in rock, with bottom elevation at 292 feet, mean sea level. The channel immediately upstream of the tower will contain trash bars, a concrete platform at elevation 320 feet, mean sea level, and a stoplog control storage weir,

discharging into the gated conduit with a maximum crest elevation of 312 feet, mean sea level. The 6 stoplog openings of the control weir will be 4 feet deep for flexibility in operation of the permanent pool. To control trash, a log boom will also be provided.

b. Intake Tower and Operating House. - The Intake Tower will be located about 177 feet upstream of the centerline of the dam and will be a dry well type structure about 120 feet in height, including the 30-foot high operating house, and will be provided with a service bridge for access. Lightning arresters will be provided for the tower and operating house. The lower part of the structure will contain the gate chamber and two 3-foot wide by 4-foot high rectangular entrance conduits at invert elevation 292 feet, mean sea level, controlled by vertical service slide gates. There will be no emergency gates; however, a stoplog structure will be provided. The service gates will be operated by a central high-pressure oil system. The pier will be extended upstream to support a platform at elevation 320 feet, mean sea level, and the stoplog slots. Access will be provided along the 12-foot wide berm of the dam.

The intake tower will contain three floors: (1) the heater room floor (elevation 370.33), (2) operating floor (elevation 382.0), (3) the equipment room floor (elevation 315.0). The operating tower will house the high pressure oil hydraulic system for operation of the gates, a continuous water stage recorder, an electrical switchboard, an emergency diesel engine generator and a highlift crane. The heater room floor will contain a forced warm air heating system and oil pump and motor standby unit. The gate chamber at elevation 300.5 will contain two individually hydraulically operated service slide gates, and a sump pump located in a well. Electric power will normally be obtained from commercial sources.

The two 3-foot wide by 4-foot high entrance conduits under the intake tower will extend on parallel axis 8 feet apart thru the tower to a point approximately 11 feet downstream from the centerline of the service gates. At this point, the alignment of the two conduits will be turned to converge toward the center of the single conduit. The dividing wall will terminate 30 feet downstream of the centerline of the gates. The section at the end of the dividing wall will be rectangular and will gradually be warped to a 3-foot by 5-foot high rectangular shaped conduit in a distance of approximately 26 feet.

c. Conduit. - The 3-foot wide by 5-foot high rectangular shaped conduit constructed on rock under the dam will have a total

length (excluding transition) of approximately 260 feet with its upstream invert at elevation 292 feet, mean sea level. The conduit will slope about 1.5 percent for a distance of 66 feet beyond the transition and then change to a grade of about 5 percent to the portal outlet at elevation 276 feet, mean sea level. The conduit will be reinforced concrete. Seep collars will be provided if required.

d. Stilling Basin. - The stilling basin will be of reinforced concrete founded on rock. It will have an overall length of 68 feet, its bottom width will flare from 3 feet at the portal to 14 feet in a distance of 35 feet with a drop in elevation from 276 feet, mean sea level, to 270 feet, mean sea level. The horizontal floor of the stilling basin will be 31.5 feet long. An end sill and baffle blocks will be incorporated in the design. Anchors and drainage holes will be provided where required.

31. Reservoir Clearing. - The portion of the reservoir below elevation 313 feet, mean sea level, which is 3 feet above the top elevation of the permanent pool (elevation 310) will be cleared. The area at this elevation is approximately 26 acres. Only about 8 acres of the land to be cleared are wooded.

32. Administrative Facilities and Utilities. - A combined utility building and garage, 24 feet by 40 feet, 6 inches, will be constructed in the left abutment of the dam. See Plate No. 3-4. The building will include office, toilet, heater room, workshop and garage facilities, and comfort station for public use.

Consideration will be given to locating the utility building and parking area adjacent to the access road depending on the final location and grade of the relocated Route No. 63.

33. Access Roads and Railroad Facilities. -

a. Access Roads. - The site is located on Connecticut State Route No. 63 which will be relocated. The relocated road will be adjacent to the west abutment of the dam and will serve as the main access road. Access to the reservoir and permanent pool area will be via the existing roads within the project area.

b. Railroads. - Railroad transportation is available in Waterbury on the New York, New Haven and Hartford Railroad. The distance to the nearest unloading facilities is about 3 miles.

34. Use of Consultants. - The Hop Brook Reservoir Project imposes no complex design problems. Technical specialists of the

Office of the Chief of Engineers will be consulted and their services utilized in establishing the design criteria and the design and safety of the proposed structures and facilities.

L. SOURCES OF CONSTRUCTION MATERIAL

35. Materials for Earth Embankment Construction. - Materials for construction of earth embankments will be obtained from required excavations in the spillway channels and from an impervious borrow area upstream of the dam on the right abutment.

Pervious materials are available from commercial sources within a 5-mile radius of the project.

36. Rock Slope Protection. - Required rock excavation in the spillway area will produce a generally sound durable rock consisting principally of granitized schist and gneiss. Large boulders and blocks scattered throughout the spillway and damsite areas may be used as an additional source of rock slope protection material.

37. Concrete Aggregates. - Aggregate studies made in conjunction with other projects recently completed and under construction in the immediate area have proved that satisfactory material can be obtained from commercial sources within a 15-mile radius.

38. Additional Investigations. - Subsurface investigations for further delineation are being made in the proposed borrow area for random and impervious materials.

M. RESERVOIR MANAGEMENT AND PUBLIC USE

39. Fish and Wildlife Resources. - The U. S. Fish and Wildlife Service, in cooperation with the Connecticut Board of Fisheries and Game has prepared reports on the fish and wildlife aspects of four flood control reservoirs on tributaries of the Naugatuck River within the Housatonic River Basin. Hop Brook Dam and Reservoir is included therein. The basic report, dated 25 April 1960, and a review report, dated 27 November 1963, are included as Exhibit Nos. 3-1 and 3-3 of this memorandum.

The review report confirms the general applicability of comments and recommendations contained in the basic report. Refinements have been made to data appearing in the project plan. Hop Brook is considered a locally important trout stream which is estimated to provide about 2,250 angler-days through a stocking program.

The partly wooded reservoir area provides high quality small game habitat and involves lands on which the State Board of

Fisheries and Game currently has hunting agreements. The project area is estimated to provide about 1,220 hunter-days annually. Three quarters of this effort is spent on harvesting rabbit, woodcock, grouse and squirrel with the remainder accounted for by hunters seeking pheasant which is stocked by the State.

As a means of mitigating losses to the recreational, and fish and wildlife resources which will result from the operation of the project, provision has been made for the inclusion of a conservation pool at elevation 310 feet, m.s.l., which has a surface area of about 21 acres and a maximum depth of about 18 feet. Control of pool level is affected by a stoplog structure. Boat launching ramps and parking facilities will be provided.

The Board of Fisheries and Game of the State of Connecticut indicates it is prepared to undertake management activities under a suitable lease agreement.

More detailed discussion of the fish and wildlife program will be contained in Design Memoranda Nos. 9 and 9A, the Preliminary and Master Plans for Reservoir Development.

40. Recreation. - The Hop Brook Reservoir will be adjacent to the existing 120-acre Whittemore Glen State Park and will supplement present park values. The upper portion of the reservoir may be utilized as part of the existing "Naugatuck Controlled Shooting Area". Several attractive picnic areas are available.

The conservation pool will be initially used for boating and fishing. Analysis of the water quality of Hop Brook by State agencies indicate a degree of pollution which will preclude public swimming and bathing until abatement measures are undertaken.

The reservoir is located in the populous west central area of Connecticut. The 1960 census showed a population of about 1.3 million people within a radius of 25 miles of the project and about 2.4 million within an hour's drive, or forty miles. The three communities adjacent to the project have a population of about 131,000. The growth rate in this section of the state is about a 25 percent increase over the 1950 census. Pressure is constantly increasing for more public outdoor recreational opportunities.

Determination of appropriate extent and type of basic facilities to be provided for the accommodation of the using public will be made after further consultation with interested Federal and State agencies. The recommended program will then be incorporated in the Master Plan for approval.

N. REAL ESTATE

41. General. - The acquisition of land for the Hop Brook Dam and Reservoir will be by fee purchase except any lands which are a part of Whittemore Glen State Park and are required for reservoir purposes only will be taken under a flowage easement.

42. Area Description. - The Hop Brook Reservoir is located in the City of Waterbury and the Towns of Middlebury and Naugatuck. The dam is located on Hop Brook about 1.4 miles above the confluence of Hop Brook and Naugatuck River.

The dam will be located on Hop Brook about 1,000 feet easterly of the southeasterly corner of the Town of Middlebury. The south line of the City of Waterbury will cross the center line of the dam. Thus, a portion of the dam will be in the Town of Naugatuck and a part in the City of Waterbury.

Part of the proposed taking is an attractive residential neighborhood. The homes range from \$15,000 to \$30,000 in value. There are several small ponds in the neighborhood. One of these is owned by the Naugatuck Fish and Game Club. The dam site is within the Whittemore Glen State Park. This section of the Hop Brook Valley is very narrow with steep valley walls having a cover of large hemlock trees and a mixture of hardwood trees.

Waterbury is an old heavily congested industrial city. The migration of its population has greatly influenced the growth of the bedroom towns of Middlebury and Watertown.

The undeveloped road frontages in the neighborhood are being developed for residential purposes.

43. Land Requirements. - Fee simple title will be acquired for lands required for project operation including areas for construction, permanent structures, borrow, highway relocations and the reservoir except the Whittemore Glen State Park.

In conducting the acquisition program in accordance with the regulations set forth in EM 405-2-150, dated 1 October 1958, as amended 31 May 1963, Real Estate Planning and Project Authorization, Civil Works Projects, the minimum guide taking line for the Hop Brook Dam and Reservoir Project would be established at 300' horizontally from the static full pool elevation (Spillway Crest 364 feet, m.s.l.). Under this plan of acquisition it is estimated that 570 acres would be acquired in fee at an estimated total real estate cost of \$1,850,000.

(-45)
The field study revealed that there were twenty residences within the 300-foot strip along the westerly and northerly portions of the proposed reservoir; therefore, an alternate plan of acquisition was studied and estimated. Under this plan, it is estimated that 525 acres would be acquired in fee at an estimated total real estate cost of \$1,415,000. Thus, under the alternate plan there will be a saving of approximately \$435,000. It follows good real estate practices, good public relationship, yet does not reduce the potential recreation features or operation of the project.

It is requested that considerations be given to the alternate plan of acquisition which will be set forth in detail for approval in the forthcoming Real Estate Design Memorandum No. 4.

44. Relocations. - No real estate costs are estimated for relocations in this section, except the land requirements for the relocation of State Route No. 63. All other relocations items will be included in the forthcoming Real Estate Design Memorandum No. 4 and Relocations Design Memorandum No. 5.

45. Severance Damages. - Since most of the improved units within the proposed taking line are residential properties, when whole lots will be taken, severance damages will be at a minimum and are estimated at \$10,000.

46. Water Rights. - No water rights are known to exist within the reservoir area.

47. Mineral and Crop Damages. - No instance of special value attributed to mineral deposits or growing crops has been noted.

48. Valuations. -

a. Land

Commercial	5 Acres @	\$7,500	\$ 37,500
Residential	21 "	@ 4,500	94,500
Developable	277 "	@ 1,500	415,500
Rear Land	200 "	@ 300	60,000
Roads	22 "	@ 0	0
TOTAL 525 Acres			\$607,500

b. Improvements

42 Residences with Outbuildings	
2 Commercial Establishments	
1 Fish and Game Club Building	583,050
TOTAL LAND AND IMPROVEMENTS \$1,190,550	

For'd	\$1,190,550
c. Severance Damages	10,000
d. Resettlement	29,325
e. Acquisition Costs	
Est. 65 Tracts @ \$1,000	<u>65,000</u>
Sub-Total	\$1,294,875
Contingencies	<u>120,125</u>
TOTAL REAL ESTATE COSTS	\$1,415,000

Values, costs and the other data contained in this estimate are subject to subsequent refinement when adequate tract data are available and will be more fully discussed in Real Estate Design Memorandum No. 4.

Pending submission and approval of the Reservoir Management Plan, no provision except for the permanent pool has been included herein for possible requirements of land for additional public access or for wildlife or recreational purposes.

O. RELOCATIONS

49. Relocations. -

a. Roads. - Portions of the following roads serving traffic with average daily traffic volumes of 100 - 6,800 vehicles are located within the reservoir area. Actions to be taken for the portions of the roads involved are indicated below:

<u>Road</u>	<u>Action</u>
State Route - Route No. 63	Relocated 1,424,000
Bristol Street	Abandoned
State Route - Allerton Farm Road	Relocated 15,000
State Route - Route No. 188	Relocated 37,000
County Route - Country Club Road	Raised 9,000
County Route - Highland Avenue	Improved 35,000
	<u>1,540,000</u>

Route No. 63 will be relocated for a distance of approximately 1.8 miles on the westerly side of the reservoir. A short section of Route No. 188 will be relocated to connect with relocated Route No. 63.

A portion of Bristol Street within the reservoir area and the bridge over Hop Brook will be abandoned. Highland Avenue, from Bristol Street southerly to the Naugatuck Town Line, will be improved to provide a substitute route from Route No. 63 to Bristol Street via Highland Avenue, Spring Street and Porter Street.

A section of Allerton Farm Road will be relocated outside the reservoir area. A short section of Country Club Road which crosses the reservoir area east of Route No. 63 will be raised.

A total of approximately 2.6 miles of existing roads within the reservoir will require relocation, raising or improvement and 2.2 miles will be abandoned.

b. Utilities. - Utilities requiring relocation consist of electric distribution, transmission, and telephone lines in the reservoir area and along the portion of existing roads which are to be relocated. The power transmission line consisting of 2 - 115 kv lines crossing the reservoir will require raising.

50. Method of Accomplishment. -

a. Roads. - Relocation of Route No. 63, Route No. 188, and the new connection to Allerton Farm Road will be accomplished by the Connecticut State Highway Department under a relocation contract.

Highland Avenue will be improved by widening, resurfacing, and elimination of dangerous reverse curves. A portion of Country Club Road easterly of Route No. 63 will be raised. Improvement of these roads will be accomplished by the Government to conform with geometric highway design standards of the Connecticut State Highway Department for existing traffic volumes. Construction will be included in the (multi-purpose component) contract for the project. The estimated cost of raising, relocating and improving all roads is \$1,540,000. All proposed road relocations and detailed cost estimates will be described in Design Memorandum No. 5 - Relocations.

b. Utilities. - The utility relocations will be accomplished by negotiated agreements with the owners; namely, the Connecticut Light and Power Company and Southern New England Telephone Company. The compensation to the owners will be based on replacement in kind, without betterment, or abandonment and removal where the service is no longer required and will include furnishing engineering services, preparing plans, and accomplishment of the required relocations; all of which are subject to the relocation procedure and approval of the Government.

The project will also affect a portion of the existing 2 - 115 kv transmission lines. These lines will require raising between two towers. This will be accomplished by replacing one tower with a higher tower in conjunction with the raising of a portion of Route No. 63. The total cost of utility relocations is tentatively estimated to be \$70,000. All proposed utility relocations and detailed cost estimates will be described in Design Memorandum No. 5 - Relocations.

P. COST ESTIMATES

51. Current Cost Estimate. - The total estimated cost of the Hop Brook Reservoir Project is \$4,800,000. A summary of the cost of the various features of the work described in this Memorandum is shown in Table I below. Breakdown of the estimate is shown in Table II, page 31.

TABLE I

SUMMARY OF FEDERAL COSTS (March 1964 Price Level)

<u>Project Feature</u>	<u>Cost</u>
Lands and Damages	\$1,415,000
Relocations	1,610,000
Reservoir	15,000
Dam	1,130,000
Recreational Facilities	50,000
Buildings, Grounds and Utilities	52,000
Permanent Operating Equipment	20,000
Engineering and Design	308,000
Supervision and Administration	200,000

TOTAL ESTIMATED PROJECT COST. . . \$4,800,000

52. Comparison of Estimates. - The following tabulation shows the comparison of the current cost estimate with the latest approved PB-3 cost estimate and with the project document cost estimate:

<u>Cost Account No</u>	<u>Project Feature</u>	<u>Current Estimate</u>	<u>PB - 3 Estimate</u>	<u>Project Document Estimate</u>
01	Lands & Damages	\$1,415,000(1)	\$1,360,000	\$1,222,000
02	Relocations	1,610,000(2)	1,570,000	374,000
03	Reservoir	15,000	20,000	17,000
04	Dam	1,130,000(3)	830,000	702,000
14	Recreational Facilities	50,000(4)	40,000	
19	Buildings, Grounds & Utilities	52,000(5)	40,000	4,000
20	Permanent Operating Equipment	20,000(6)	15,000	5,000
30	Engineering & Design	308,000	265,000	155,000
31	Supervision & Administration	200,000	160,000	101,000
TOTAL ESTIMATED PROJECT COST..		\$4,800,000	\$4,300,000	\$2,580,000

(1) Previous estimate was based on acquisition of reservoir lands in fee to the 5-year frequency flood flow line and easement for the remainder. The current estimate is based on a minimum guide taking line at 300 feet horizontally from the static full pool elevation east of the reservoir and five feet above static full pool elevation north and west of the reservoir. Full discussion will be forthcoming in Design Memorandum No. 4 - Real Estate.

(2) New estimate for road relocations is based on revised criteria in accordance with Section 207(b), P. L. 86-645.

(3) Increase due to flatter slopes of embankment.

(4) New item.

(5) Increase due to inclusion of new utility building.

(6) Permanent operating equipment required for maintenance by full-time operator.

Q. SCHEDULES FOR DESIGN AND CONSTRUCTION

53. Design. - Preparation of plans and specifications for the relocation of State Route No. 63 will be completed by the Connecticut State Highway Department in June 1964. Preparation of plans and specifications for the dam and appurtenant structures will be completed in December 1964.

54. Construction. - It is estimated that three full construction seasons will be required for the completion of this project.

55. Relocations. - State Route 63 passes through the dam site. Therefore, its relocation must be initiated early in the construction program to clear the work area for the construction of the dam. The budget for Fiscal Year 1964 does not contain funds to initiate construction for the Hop Brook Project. Construction funds are included in the President's Budget for Fiscal Year 1965 in an amount sufficient to start construction in the Spring of 1965. Therefore, the construction of the relocated road will be initiated in the Spring of 1965 and completed in the Fall of 1966. The work will be accomplished under an agreement with the Connecticut State Highway Department which will administer the construction contracts. Construction of the relocation of electric distribution, transmission, and telephone lines will be accomplished under separate contracts to be negotiated with the respective utility companies in Fiscal Year 1965.

56. Dam and Appurtenant Structures. - Construction of the dam, outlet works, spillway, raising of Country Club Road, improvement of Highland Street, and clearing of the reservoir will be accomplished under a single continuing contract to be awarded early in calendar year 1966.

a. First Season. - Early in the construction season, the contractor will mobilize, and initiate and complete the clearing and grubbing of the site of the structures and borrow area. Earth and rock excavation for the outlet works and construction of the conduit and lower part of the intake tower to elevation 345.0 mean sea level, will be accomplished so that the brook could be diverted in the early summer. The excavated materials from the outlet works will be utilized in the construction of the dike. The foundation cut-off trench and grout curtain wall will be initiated and completed. Since the volume of the dam is not large, the dam embankment will be constructed to elevation 380.0, therefore the need of a permanent cofferdam is not deemed necessary. To effect the brook diversion and construct the dam embankment in the dry, temporary upstream and downstream cofferdams will have to be constructed.

The contractor will initiate the construction of the spillway insofar as the earth and rock excavation will be required for the embankment, which will be initiated and completed after diversion.

The improvement of Highland Street will be accomplished during this season.

b. Second Season. - The contractor will initiate and complete the piers and service bridge. Construction will be continued and completed on the spillway and dam embankment. The utility building will be initiated and completed. The raising of Country Club Road will be accomplished this season. All work will be completed in the Fall of 1967.

57. Funds Required. - The construction schedule is based on the assumption that funds for construction of the project will be first appropriated in Fiscal Year 1965, and that additional funds will be appropriated as required. It is therefore estimated that funds will be required by fiscal years approximately as follows:

<u>Fiscal Year</u>	<u>Amounts Required</u>
1965	\$ 400,000
1966	2,300,000
1967	1,565,000
1968	360,000
Sub-Total	\$4,625,000
Allotted through FY 1964	175,000
TOTAL PROJECT ESTIMATE.	\$4,800,000

The construction schedule and yearly appropriations required are included as Plate No. 3-12.

R. OPERATION AND MAINTENANCE

58. General. - The Hop Brook Dam and appurtenant structures will be operated and maintained in conjunction with the other flood control reservoirs in the Naugatuck River Basin by the United States under the supervision of the Division Engineer, Waltham, Massachusetts.

59. Operation of Reservoir. - The Hop Brook Reservoir will be coordinated with the operation of the Thomaston Reservoir to provide protection to the downstream communities. In order to effectively reduce flood peaks on the lower Naugatuck River, it will be necessary to regulate the three gated reservoirs so as to desynchronize their peak flows with those from the uncontrolled drainage areas and the ungated reservoirs. This operation will be effected whenever flows are expected to exceed downstream channel capacities at damage centers.

60. Maintenance. - Periodic inspection of the dam and appurtenant structures and equipment will be made. The dam and appurtenant structures will be maintained and operated by a permanent damtender who will be added to the Naugatuck River Basin complex staff. Maintenance will be based on regular, detailed inspection of the entire works, including all operations necessary to preserve the structures. The staff will be under the general supervision of the Operations Division of the New England Division.

61. Annual Charges. - The estimated annual cost of maintenance and operation of the Hop Brook Dam and Reservoir is \$15,000 and the estimated cost of major replacements is \$1,500.

S. RESERVOIR REGULATION

62. Reservoir Regulation. - The proposed flood control plan for the lower Naugatuck River includes the gated reservoirs at Thomaston on the Naugatuck River, Black Rock on Branch Brook, and the ungated reservoirs on Northfield and Hancock Brooks. Protection for the upper Naugatuck River basin area will be provided by East Branch and Hall Meadow Brook Reservoirs which will also reduce the peak inflow to Thomaston Reservoir. In order to effectively reduce flood peaks on the lower Naugatuck River, it will be necessary to regulate the three gated reservoirs so as to desynchronize their peak flows with those from the uncontrolled drainage areas and the ungated reservoirs. These three gated reservoirs will be controlled by the operator at the Thomaston Dam. The Hop Brook Reservoir will contribute to the protection of the downstream communities of Naugatuck, Ansonia, Derby and Shelton. There will be no operator's quarters provided at the Hop Brook Dam. Upon instructions from the Reservoir Regulation Section, gate regulation will be accomplished by a revolving team under the supervision of the Thomaston Flood Control Dam Operator.

A hydrologic radio network has been authorized for the Naugatuck River basin. Included in the network there will be a radio gage to report the pool elevation at Hop Brook upon command to Thomaston Dam and the New England Division.

63. Frequency of Filling. - The frequency of filling curves is shown on Plate No. 1-11 in Design Memorandum No. 1. Since a recreation pool will be maintained at elevation 310 feet, mean sea level, the guide curve shows the estimated frequency of the pool levels above this elevation. Some selected values from the curve are shown in the following tables:

<u>Frequency</u> <u>(In Years)</u>	<u>Pool Level</u> <u>(In.ft.,msl)</u>
Minimum	310
1	333
2	338
5	345
10	350
25	358
50	364 (spillway crest)

T. HEALTH CONTROL

64. Public Health, Insect and Other Control. - An evaluation report which included the Hop Brook Flood Control Project was furnished as inclosure to letter from the U. S. Health, Education and Welfare, dated January 30, 1957. The report was confirmed in letter, dated November 7, 1963, and is included in this Memorandum as Exhibit No. 2-1.

The reservoir will be cleared of trees and brush to an elevation of 3 feet above the permanent pool level and drainage will be provided for borrow areas outside the reservoir.

U. ECONOMICS

65. General. - The densely populated Naugatuck River Valley is one of the key industrial concentrations in the United States. The Valley's industries produce about 40 percent of the country's brass and bronze industrial shapes and a large part of the aluminum, zinc and copper products.

The destructive flood of August 1955, caused damages of \$194,000,000 in the reaches of the Naugatuck River below Thomaston Reservoir. Thirty-six lives were lost. A recurrence of this flood under today's economic conditions would cause losses estimated at \$227,000,000 if there were no flood protection. The Hop Brook project, acting after Thomaston Reservoir with three other authorized reservoirs, Northfield Brook, Black Rock and Hancock Brook, would prevent \$8,400,000 in losses in the reaches downstream from Thomaston Reservoir.

66. Annual Benefits. - Annual benefits were derived by determining the difference between annual losses after reductions by Thomaston Reservoir, Hall Meadow and East Branch Reservoirs and local protection at Waterbury, all built or building, and those remaining after reductions by four authorized reservoirs acting as a system with Hop Brook receiving an equitable share of the benefits. Annual losses before and after the project, were adjusted to reflect the growth which will take place in the areas of project influence over the hundred year life of the project. Average annual benefits so derived amount to \$227,900 at present day price level.

Assuming that Hop Brook is the last added reservoir in a system of seven reservoirs and a local protection project, the annual benefit is \$195,500.

In addition to flood damage prevention benefits, Hop Brook will provide redevelopment benefits by utilizing labor currently unemployed or underemployed. The entire northern portion of New Haven County, in which Hop Brook is located, has been designated as an area of substantial unemployment by the U. S. Department of Labor. Two towns within ten miles of the reservoir site have been designated as ARA areas by the Area Redevelopment Administration.

Redevelopment benefits have been computed for the project based on the estimated labor cost of the work with allowances made for the proportion of labor which will be hired locally and the number of those hired who would otherwise be unemployed or underemployed. Benefits so derived amount to \$472,000 over a three year period. Expressed as an average annual equivalent benefit over the life of the project, this amounts to \$10,500.

Total benefits to the Hop Brook project amount to \$238,400 annually.

67. Annual Charges. - Annual charges shown in Table II below have been computed in accordance with OCE Circular Letter ENGOW-PD, Subject: "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources", dated 15 June 1962, using an economic life of 100 years for the project.

TABLE II
ANNUAL CHARGES

Federal Investment

First Federal Cost	\$4,800,000
Interest during Construction ($\$4,800,000 \times 0.03 \times 1.5$)	216,000
TOTAL FEDERAL INVESTMENT	\$5,016,000

Federal Annual Charges

Interest ($\$5,016,000 \times 0.03$)	\$ 150,480
Amortization ($\$5,016,000 \times 0.00165$)	8,276
Maintenance and Operation	15,000
Major Replacement	1,500
TOTAL FEDERAL ANNUAL CHARGES	\$ 175,256

ROUNDED TO: \$ 175,300

68. Benefit - Cost Ratio. -

$$\text{Benefit - Cost Ratio } \frac{\$238,400}{\$175,300} = 1.4$$

W. RECOMMENDATION

69. Recommendation. - It is recommended that the project plan submitted in this Memorandum be approved as a basis for preparation of Detailed Design Memoranda and contract plans for the Hop Brook Dam and Reservoir Project.

TABLE III
DETAILED COST ESTIMATE
(March 1964 Price Level)

01.	<u>LANDS, RESETTLEMENT AND ACQUISITION</u>	\$1,294,875
	Contingencies	<u>120,125</u>
	Total LANDS, RESETTLEMENT AND ACQUISITION	\$1,415,000
02.	<u>RELOCATIONS</u>	
	.1 Roads (\$64,000 under multi-component contract)	\$1,339,000 20% cont.
	.2 Electric, Transmission & Telephone Lines	<u>61,000</u> 9 cont.
	Sub-Total	\$1,400,000
	Contingencies	<u>210,000</u>
	Total RELOCATIONS	\$1,610,000
03.	<u>RESERVOIR</u>	\$ 15,000
04.	<u>DAM AND DIKE</u>	

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Preparation of Site	1	Job	L.S.	\$ 22,000
Control & Diversion of River	1	Job	L.S.	12,000
Common Excavation-General	c.y.	250,000	.70	175,000
Common Excavation-Borrow	c.y.	65,000	.80	52,000
Rock Excavation-Open Cut	c.y.	46,000	2.50	115,000
Safety Mesh	s.y.	500	2.00	1,000
Line Drilling	s.y.	4,480	2.50	11,200
Compacted Impervious Fill	c.y.	45,000	.20	9,000
Compacted Impervious Backfill	c.y.	300	7.00	2,100
Compacted Random Fill	c.y.	150,000	.16	24,000
Compacted Pervious Fill	c.y.	14,000	.20	2,800
Compacted Gravel Fill	c.y.	13,500	2.50	33,750
Compacted Gravel Backfill	c.y.	500	6.00	3,000
Gravel Bedding	c.y.	16,000	2.50	40,000
Road Gravel	c.y.	1,350	2.80	3,800
Additional Embankment				
Rolling	Hrs.	100	25.00	2,500
Rock Slope Protection	c.y.	16,000	2.00	32,000

TABLE III (Cont'd)

04. DAM AND DIKE, Cont'd.

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Rock Fill	c.y.	11,500	.60	\$ 6,900
Foundation Grouting	1	Job	L.S.	20,000
Concrete-Inlet & Outlet Structures	c.y.	500	55.00	27,500
Concrete-Intake Tower to El. 320.0	c.y.	1,050	40.00	42,000
Concrete-Intake Tower, El. 320.0 to El. 370.33	c.y.	300	75.00	22,500
Concrete-Intake Tower, above El. 370.33	c.y.	180	100.00	18,000
Concrete-Transition and Conduit	c.y.	500	50.00	25,000
Concrete-Gravity Retaining Walls and Spillway Weir	c.y.	250	40.00	10,000
Concrete-Service Bridge Abutments	c.y.	240	50.00	12,000
Concrete-Service Bridge Deck	c.y.	50	90.00	4,500
Cement	bbbl.	5,000	5.50	27,500
Steel Reinforcement	lb.	275,000	.15	41,250
Rubber Water Stop	l.f.	400	4.00	1,600
Structural Steel-Miscellaneous	lb.	10,000	.65	6,500
Structural Steel-Service Bridge	1	Job	L.S.	20,000
Aluminum	lb.	4,000	2.00	8,000
Miscellaneous Metals	lb.	8,800	1.25	11,000
Intake Tower-Super-structure	1	Job	L.S.	5,000
Gate Vent System	1	Job	L.S.	6,000
Float Well & Accessories	1	Job	L.S.	8,000
Heating & Ventilating System	1	Job	L.S.	3,000
Gates & Machinery	1	Job	L.S.	45,000
Crane & Hoist	1	Job	L.S.	10,000
Diesel Engine	1	Job	L.S.	7,000
Sump Pump	1	Job	L.S.	1,000
Electrical Work	1	Job	L.S.	25,000
Tile Gages	1	Job	L.S.	2,500
Bitum. Conc. Road Surfacing	s.y.	2,400	2.00	4,800

TABLE III (Cont'd)

04. DAM AND DIKE, Cont'd.

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Cable Guard Rail	l.s.	1,250	2.00	\$ 2,500
Chain Link Fencing	l.f.	1,500	3.50	7,350
Topsoil & Seeding	s.y.	24,500	.50	12,250
Log Boom	1	Job	L.S.	<u>1,200</u>

Sub-Total DAM & DIKE \$ 986,000

Contingencies 144,000

Total, DAM AND DIKE \$1,130,000

14. RECREATIONAL FACILITIES 43,500 + 6,500 cont. \$ 50,000

19. BUILDINGS, GROUNDS AND UTILITIES

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Preparation of Site	1	Job	L.S.	\$ 1,500
Road Gravel	c.y.	250	2.80	700
Bitum. Conc., Road Surfacing	s.y.	450	2.00	900
Utility Building	1	Job	L.S.	25,000
Water Distr. System, incl. well	1	Job	L.S.	12,000
Sewage Disposal System	1	Job	L.S.	3,000
Topsoil & Seeding	s.y.	1,500	.50	750
Flag Pole	1	Job	L.S.	<u>1,450</u>

Sub-Total, BUILDING, GROUNDS & UTILITIES \$ 45,300

Contingencies 6,700

Total, BUILDING, GROUNDS & UTILITIES \$ 52,000

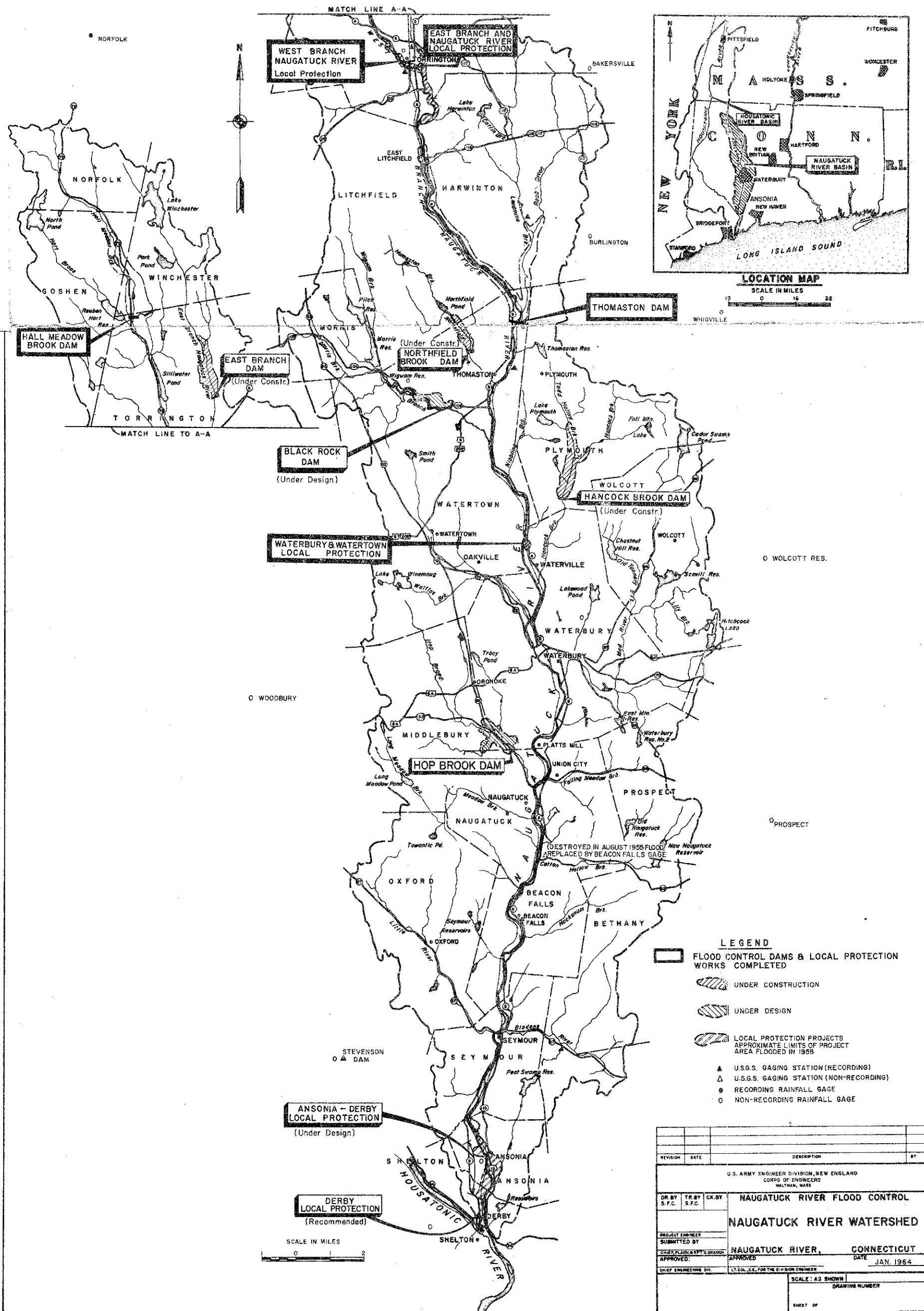
20. PERMANENT OPERATING EQUIPMENT

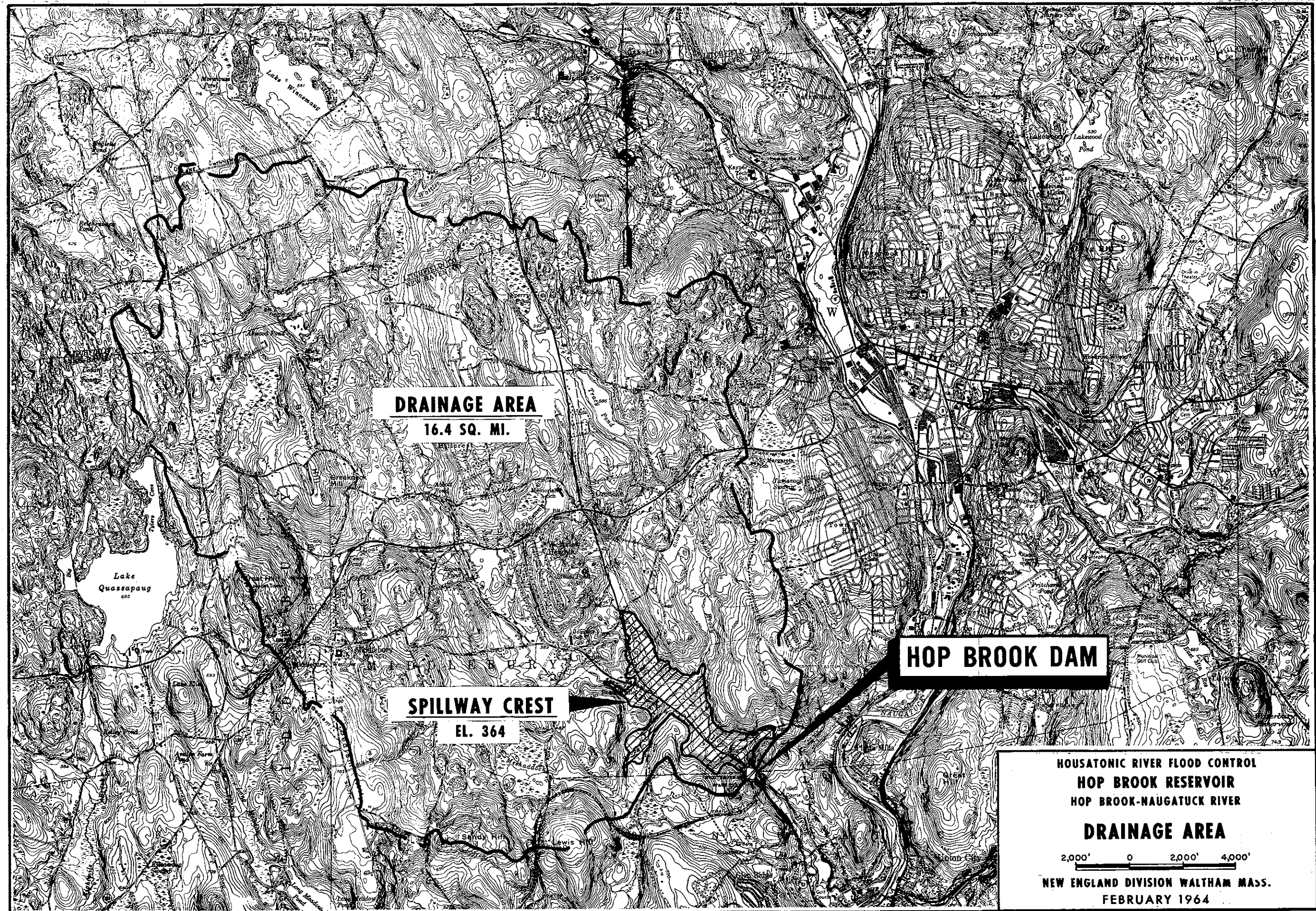
.1 Permanent Operating Equipment	\$ 15,000
.2 Sedimentation Bounds and Ranges	<u>5,000</u>

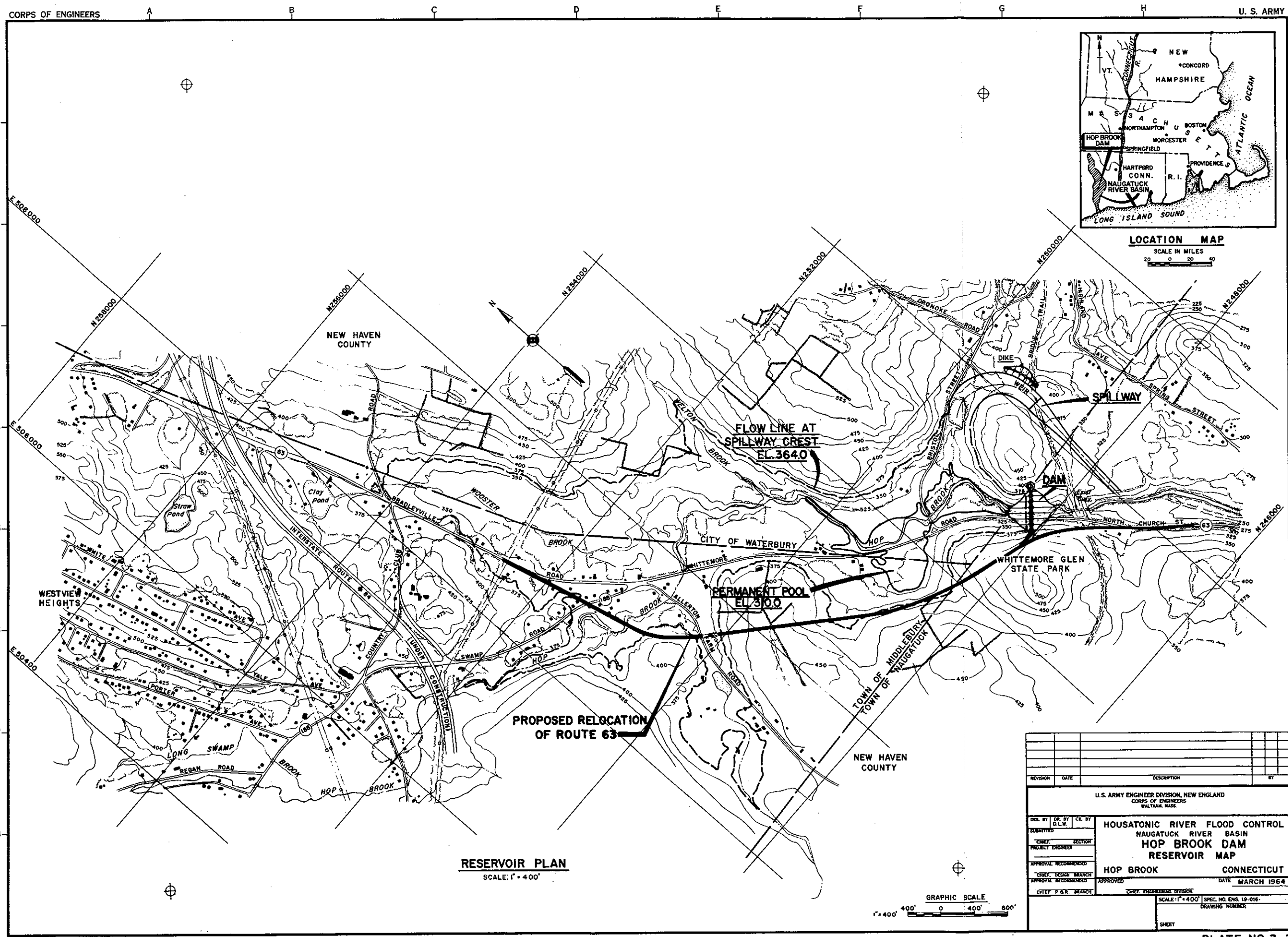
Total PERMANENT OPERATING EQUIPMENT \$ 20,000

TABLE III (Cont'd)

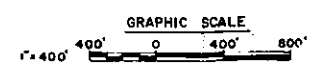
30.	<u>ENGINEERING AND DESIGN</u>	\$ 308,000
31.	<u>SUPERVISION AND ADMINISTRATION</u>	<u>200,000</u>
	<u>TOTAL PROJECT FIRST COST</u>	<u>\$4,800,000</u>





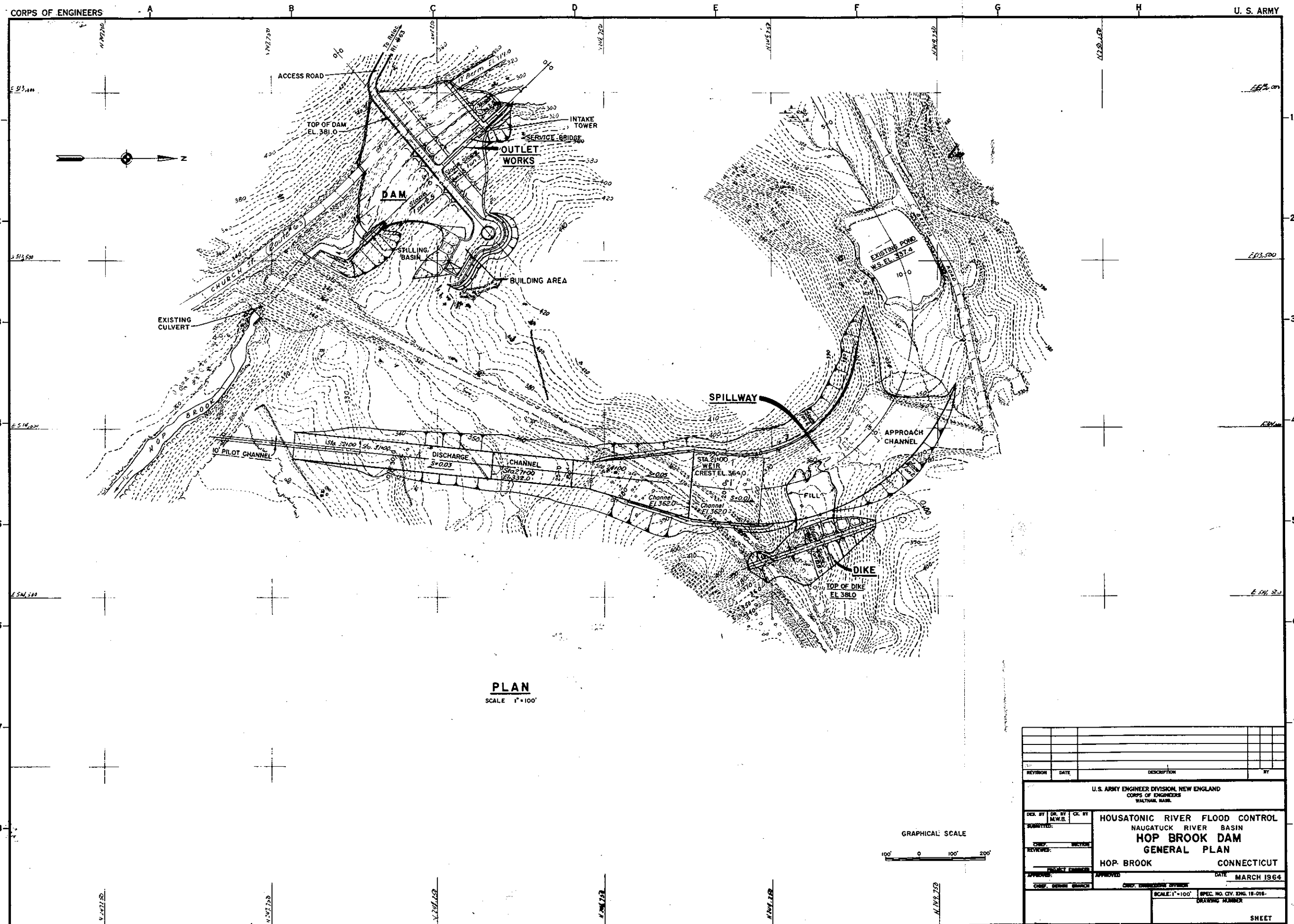


RESERVOIR PLAN
SCALE: 1" = 400'



REVISION	DATE	DESCRIPTION	BY

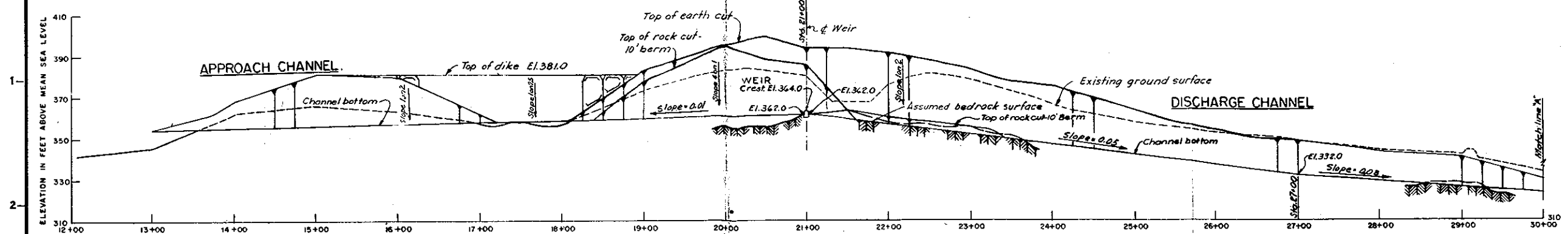
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
DES. BY	DR. BY	CL. BY	
SUBMITTED	D.L.E.		
PROJECT	SECTION		
APPROVAL RECOMMENDED			
APPROVAL RECOMMENDED			
CHIEF P. & R. BRANCH	CHIEF ENGINEERING DIVISION		
SCALE: 1" = 400'		SPEC. NO. ENG. 19-016- DRAWING NUMBER	
SHEET			



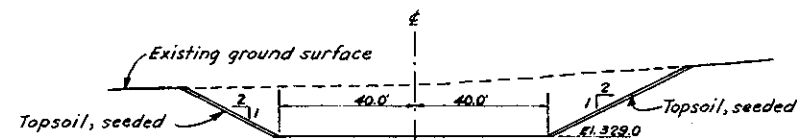
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
DES. BY	DR. BY	CL. BY	
SUBMITTED	M.W.B.		
CHECKED	SECTION		
REVIEWED			
PROJECT NUMBER	HOUSATONIC RIVER FLOOD CONTROL NAUGATUCK RIVER BASIN HOP BROOK DAM GENERAL PLAN		
APPROVED	DATE	MARCH 1964	
CORP. DESIGN BRANCH	CORP. ENGINEERING DIVISION	SCALE: 1"=100' SPEC. NO. CIV. ENR. 18-016- DRAWING NUMBER	
SHEET			



PLATE NO. 3-5

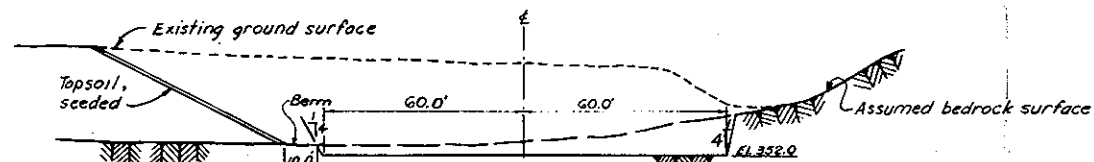


PROFILE ALONG C. OF SPILLWAY

SCALE: HOR. 1" = 50'
VERT. 1" = 20'

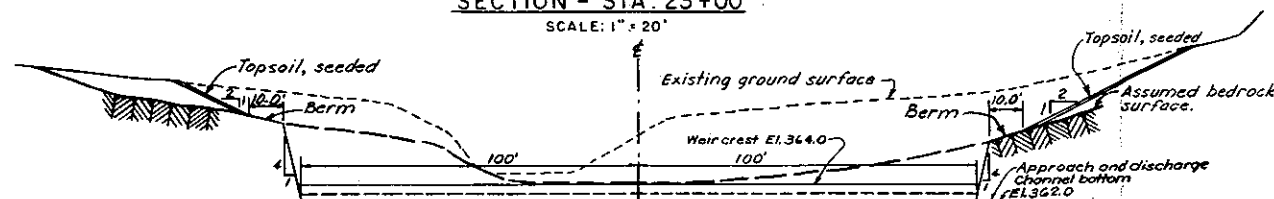
SECTION - STA. 28+00

SCALE: 1" = 20'



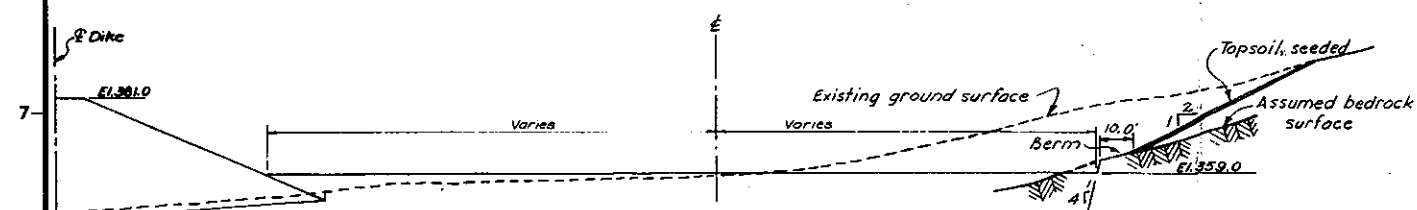
SECTION - STA. 23+00

SCALE: 1" = 20'



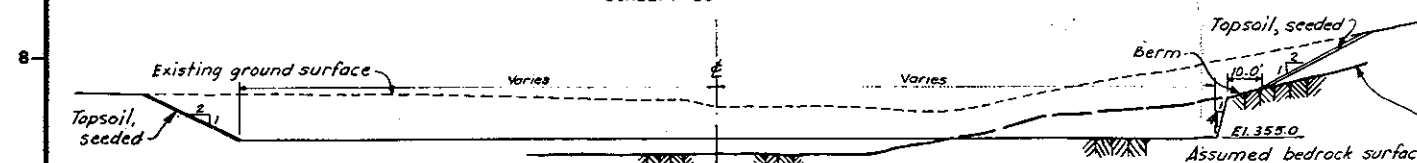
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SCALE: 1" = 20'



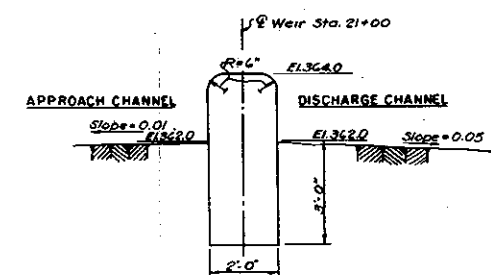
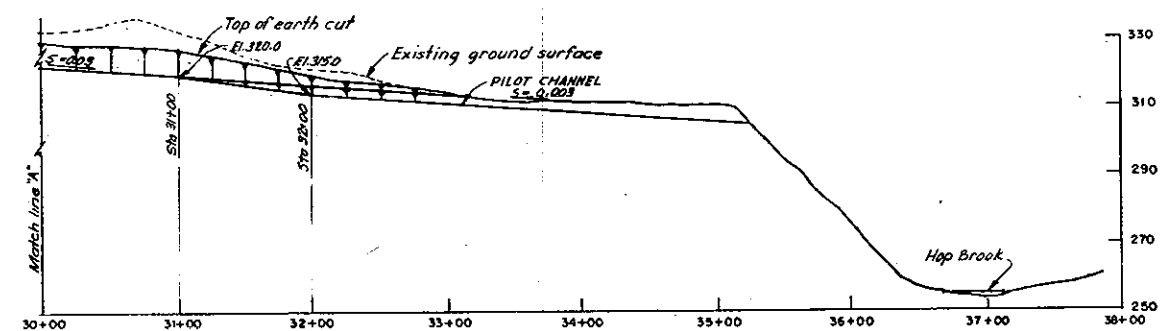
SECTION - STA. 18+00

SCALE: 1" = 20'



SECTION - STA. 14+00

SCALE: 1" = 20'



TYPICAL SECTION - SPILLWAY WEIR

SCALE 1/2" = 1'-0"

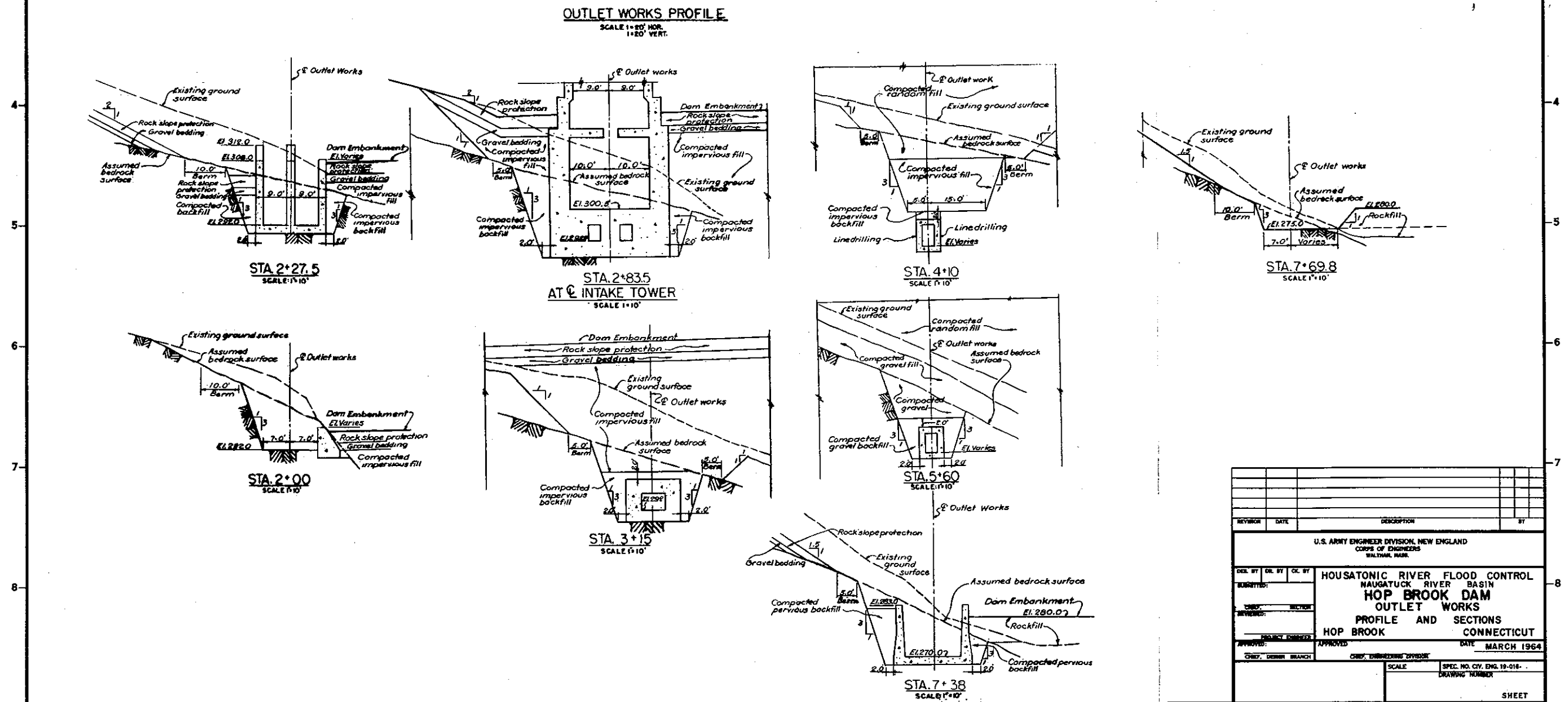
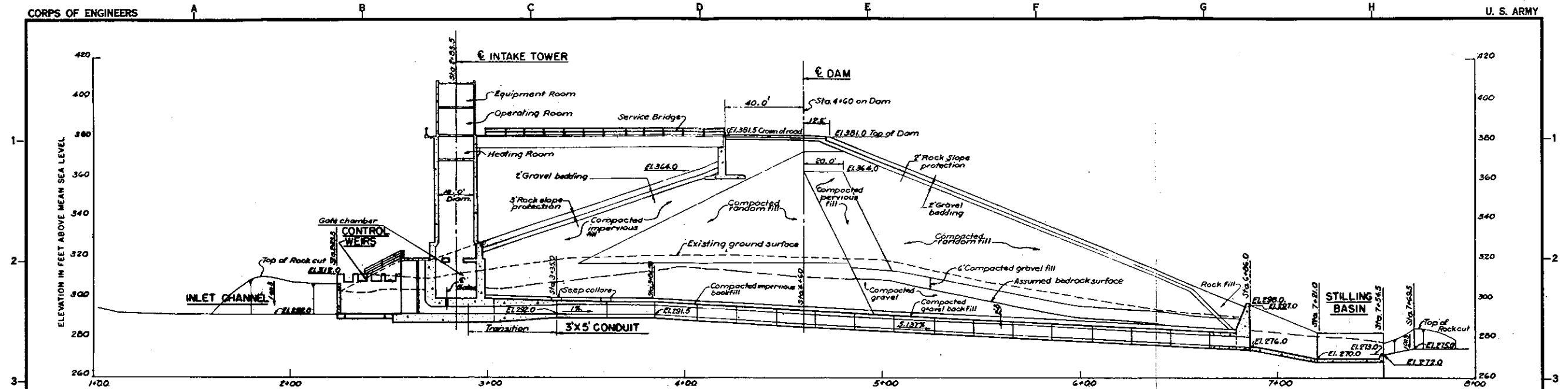
REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DESIGNED BY: []
CHECKED BY: []
APPROVED BY: []
DATE: MARCH 1964

PROJECT: HOUSATONIC RIVER FLOOD CONTROL
NAUGATUCK RIVER BASIN
HOP BROOK DAM
SPILLWAY
PROFILE AND SECTIONS
HOP BROOK CONNECTICUT

SCALE: []
SHEET NO. 3-6
DRAWING NUMBER: []



REVISION	DATE	DESCRIPTION	BY

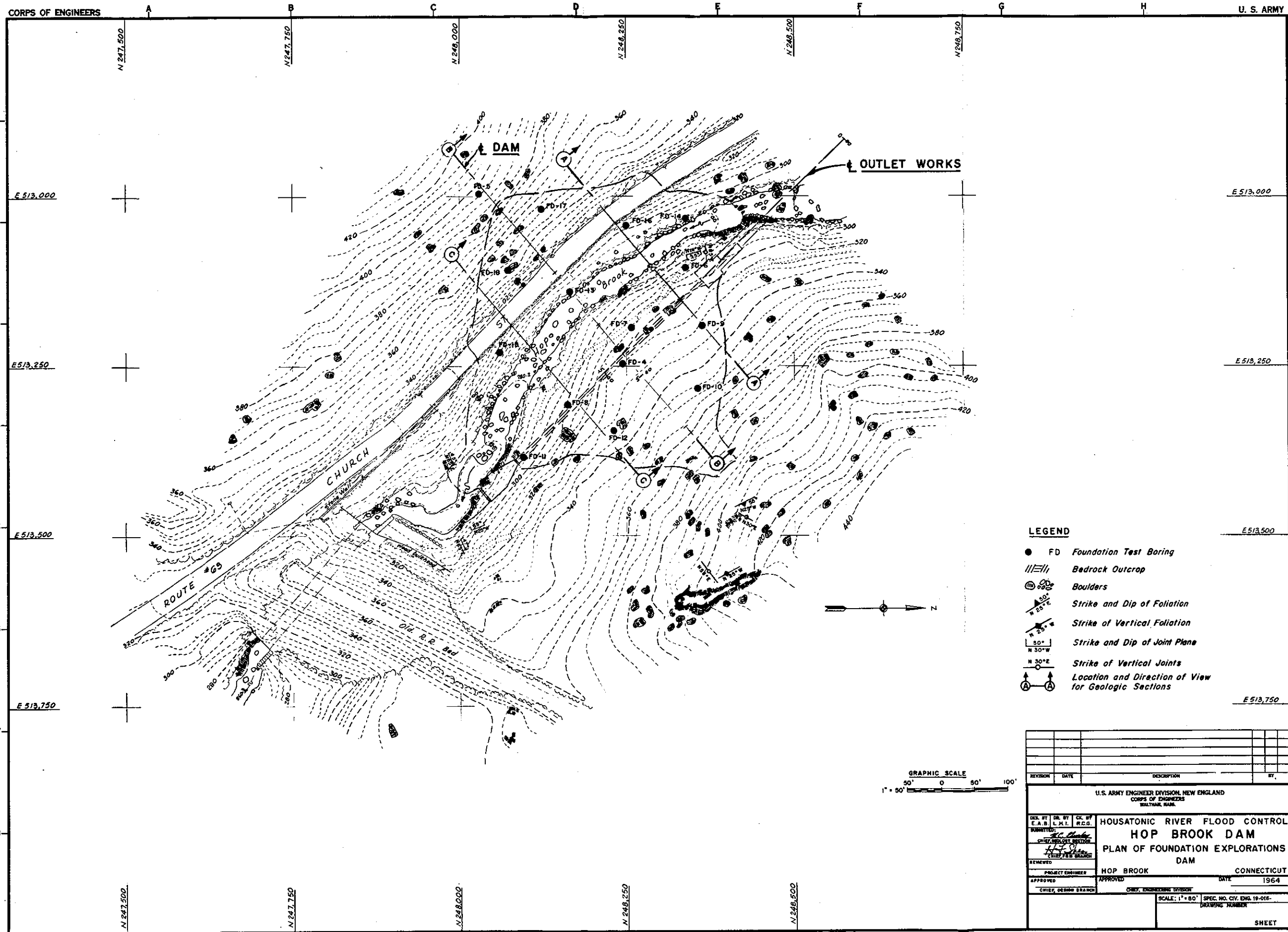
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
 CORPS OF ENGINEERS
 WALTHAM, MASS.

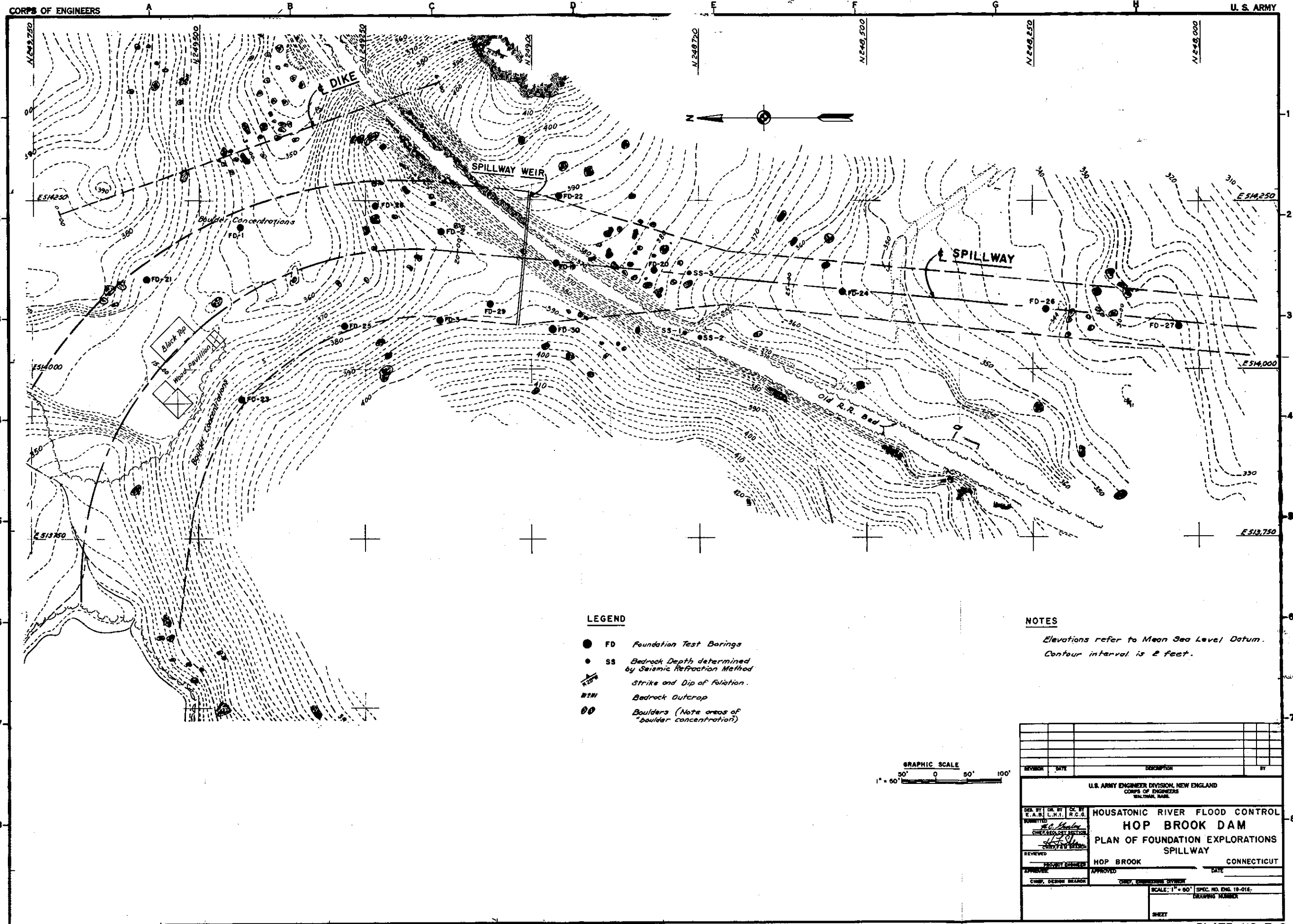
DES. BY: OR. BY:
 SURVEYED:
 CHECKED:
 PROJECT NUMBER:
 APPROVED: DATE: MARCH 1964

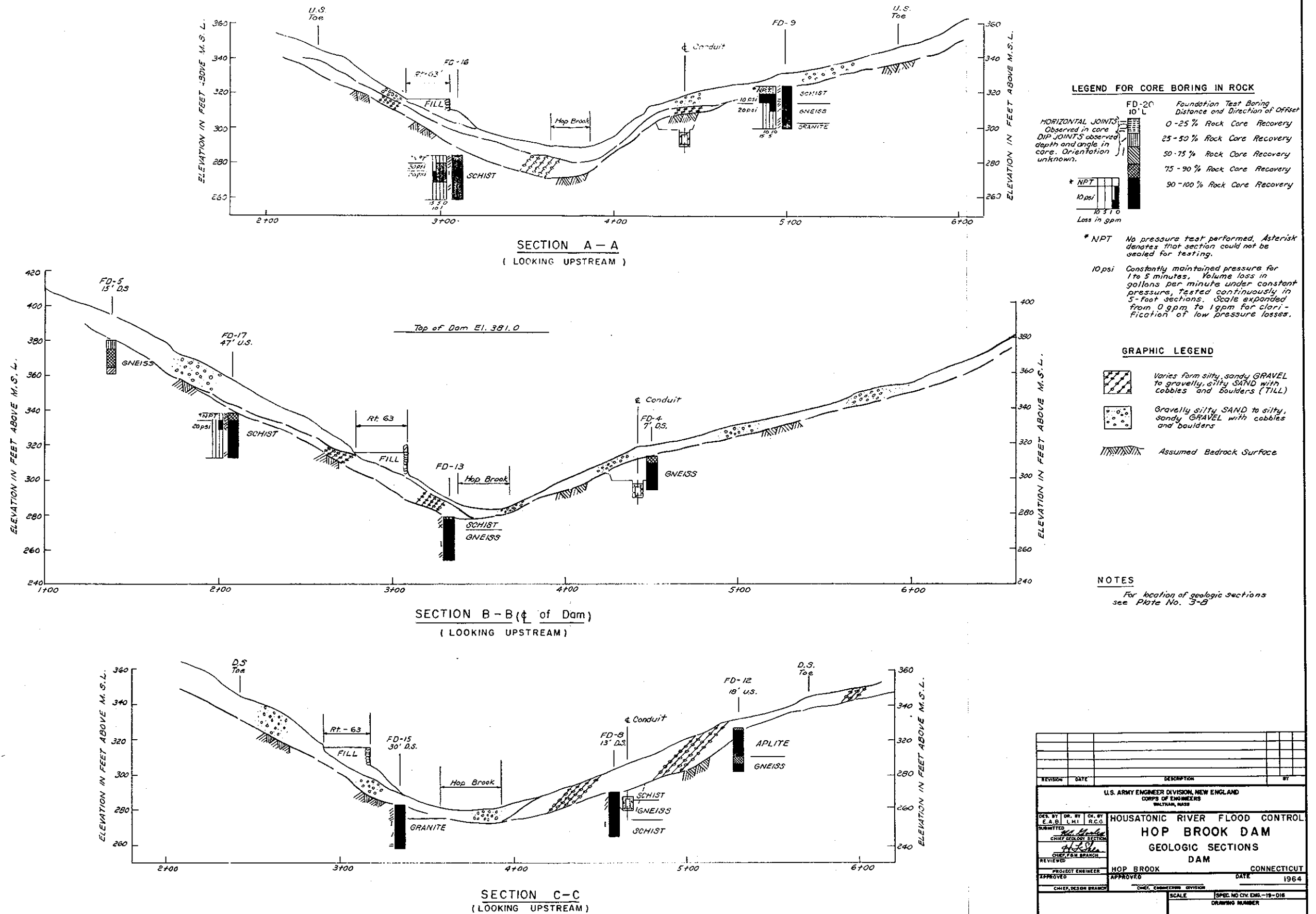
CHIEF, DESIGN BRANCH: CHIEF, ENGINEERING DIVISION:

SCALE: SPEC. NO. CIV. ENG. 19-016
 DRAWING NUMBER:

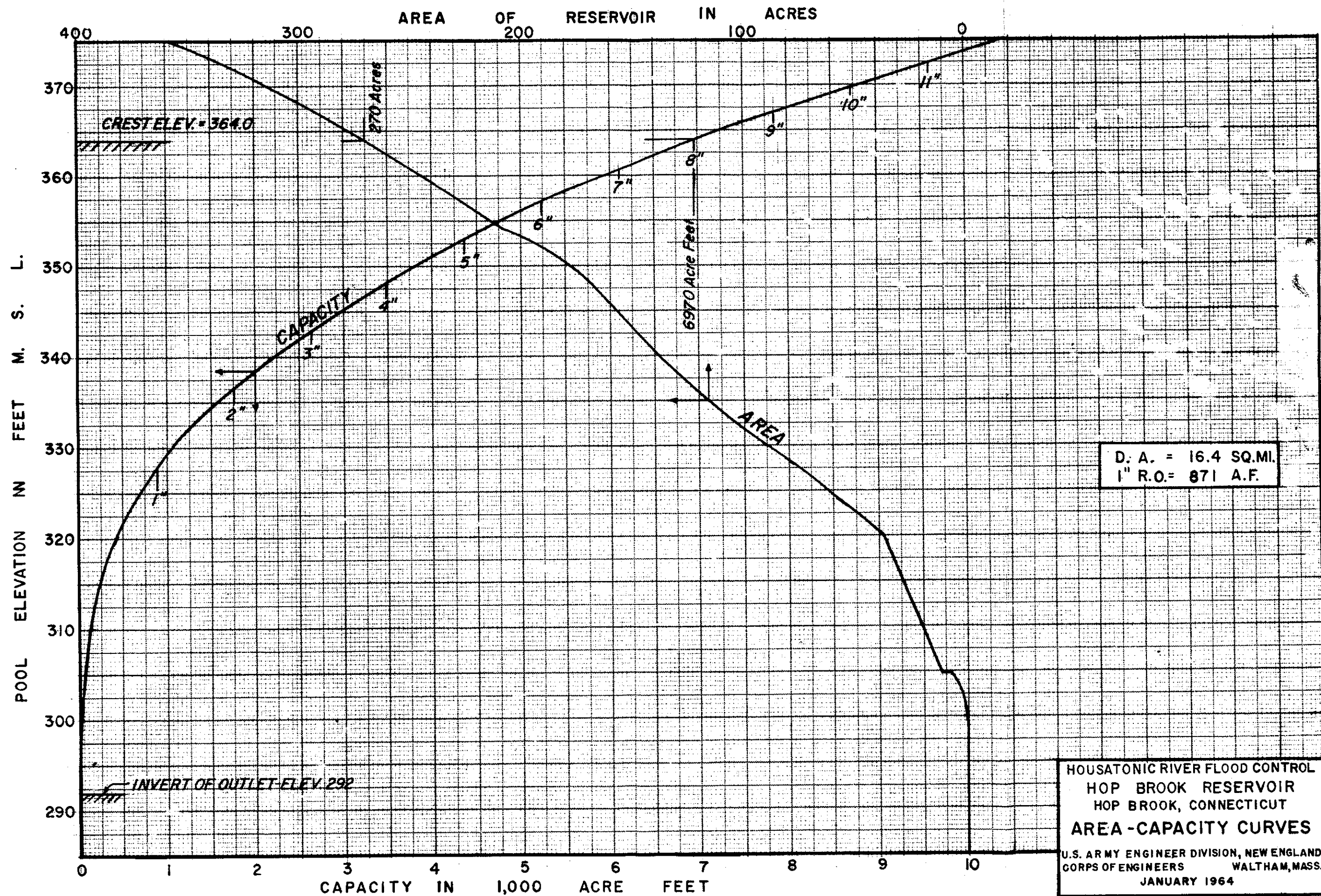
SHEET







REVISION	DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
DESIGNED BY E.A.B. L.M. R.C.O.	HOUSATONIC RIVER FLOOD CONTROL HOP BROOK DAM GEOLOGIC SECTIONS DAM		
CHIEF OF SECTION	PROJECT ENGINEER HOP BROOK		
CHIEF OF BRANCH	APPROVED DATE 1964		
CHIEF OF BRANCH	SCALE SHEET		



APPROPRIATION TITLE: Construction, General
CLASSIFICATION: RESERVOIR (FLOOD CONTROL)

PROJECT: HOP BROOK, CONNECTICUT



DETAILED PROJECT SCHEDULE

LINE NO.	COST ACCOUNT NO.	ITEM	CONT. TYPE & NO.	QUANTITY, SIZE, OR CAPACITY, DATE OF AWARD (As Applicable)	PROJECT COST ESTIMATE	TOTAL AS OF JUNE 30, 19 63	(TO BE REPORTED IN THOUSANDS OF DOLLARS)																BALANCE TO COMPLETE	LINE NO.						
							TOTAL	CURRENT FISCAL YEAR 19 64				TOTAL	BUDGET FISCAL YEAR 19 65				FUTURE FISCAL YEARS													
								QUARTERS					QUARTERS																	
								1st	2nd	3rd	4th		1st	2nd	3rd	4th	19 66	19 67	19 68	19 69	19 70	19 71			19 72	19 73	19 74	19 75	19 76	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)			
1	01.	LANDS AND DAMAGES		525 Ac.	1,415.0	1.7	4.3	0.6	0.7	1.3	1.7	100.0	5.0	15.0	50.0	30.0	800.0	454.0	55.0									1		
2																												2		
3	02.	RELOCATIONS			1,610.0							206.0				206.0	1,234.0	170.0										3		
4																												4		
5	.1	ROADS	c.c.	2.6 miles 2/65	(1,540.0)							(200.0)				(200.0)	(1,200.0)	(140.0)										5		
6																												6		
7	.2	UTILITIES	L.S.	2/65	(70.0)							(6.0)				(6.0)	(34.0)	(30.0)										7		
8																												8		
9	03.	RESERVOIR A3-1	c.c.	2/66	15.0													15.0										9		
10																												10		
11	04.	DAM A3-2	c.c.	268,000 cy 2/66	1,130.0												187.0	743.0	200.0									11		
12																												12		
13	14.	RECREATION	L.S.	7/67	50.0														50.0									13		
14																												14		
15	19.	BUILDINGS, GROUNDS & UTILITIES A3-3	c.c.	2/66	52.0																							15		
16																												16		
17	20.	PERMANENT OPERATING EQUIPMENT			20.0													20.0										17		
18																												18		
19	.1	EQUIPMENT	P.O.		(15.0)													(15.0)										19		
20																												20		
21	.2	SEDIMENTATION BOUNDS AND RANGES			(5.0)													(5.0)										21		
22																												22		
23	30.	ENGINEERING AND DESIGN			308.0	25.7	127.3	15.6	42.8	30.0	38.9	79.0	30.0	21.0	18.0	10.0	30.0	35.0	11.0									23		
24																												24		
25	31.	SUPERVISION AND ADMINISTRATION			200.0	2.6	13.4	1.5	3.1	3.0	5.8	15.0	3.0	2.0	2.0	8.0	49.0	84.0	36.0									25		
26																												26		
27		TOTAL APPLIED COST (Federal Funds Only)			4,800.0	30.0	145.0	17.7	46.6	34.3	46.4	400.0	38.0	38.0	70.0	254.0	2,300.0	1,565.0	360.0									27		
28		Undistributed Cost (None)																										28		
29		TOTAL PROJECT COST (Federal Funds Only)			4,800.0	30.0	145.0	17.7	46.6	34.3	46.4	400.0	38.0	38.0	70.0	254.0	2,300.0	1,565.0	360.0									29		
30		Pending Adjustments (None)																										30		
31		TOTAL COST (Federal Funds Only)			4,800.0	30.0	145.0	17.7	46.6	34.3	46.4	400.0	38.0	38.0	70.0	254.0	2,300.0	1,565.0	360.0									31		
32		Undelivered Orders																										32		
33		TOTAL OBLIGATIONS (Federal Funds Only)				30.0	145.0					400.0					2,300.0	1,565.0	360.0									33		
34																												34		
35		METHOD OF FINANCING																										35		
36		APPROPRIATIONS				50.0	125.0																					36		
37		UNOBLIGATED CARRYOVER FROM PRIOR YEAR					20.0																					37		
38		TOTAL FUNDS AVAILABLE FOR OBLIGATION					145.0																					38		
39		APPROPRIATION REQUIRED										400.0					2,300.0	1,565.0	360.0									39		
40																												40		
41		MULTI-COMPONENT CONTRACT																										41		
42		A-3 Reservoir, Dam, Bldgs., Grnds & Utilities	c.c.	2/66	1,197.0												187.0	802.0	208.0									42		
EFFECTIVE DATE		DIVISION		DISTRICT		BASIN																PAGE 1 OF 1 PAGES								
		NEW ENGLAND																												

FEDERAL POWER COMMISSION
REGIONAL OFFICE
346 Broadway
New York 13, New York

May 24, 1963

Division Engineer
U. S. Army Engineer Division, New England
424 Trapelo Road
Waltham 54, Massachusetts

Ref. File No. NEDGW

Subject: Hop Brook Dam and Reservoir
Hop Brook, Connecticut

Dear Sir:

Reference is made to your letter of April 26, 1963 requesting our present views on the power potentialities of the proposed Hop Brook Reservoir project as given in our letter of December 21, 1956. At that time our staff considered the possibility of developing power in conjunction with flood control by raising the dam to provide head and additional storage.

Under this plan the firm power would be less than 100 kilowatts with an average annual potential energy output of about 1.4 million kilowatt-hours. It was concluded that the costs associated with development of this small amount of power would greatly exceed the value thereof, and therefore modification of the project to provide for power development would not be warranted.

Inasmuch as the project is to be planned and constructed without multiple-purpose features or any other changes in the original plan, we find no reason to modify our prior conclusions with respect to power development at the Hop Brook Dam.

Sincerely yours,


D. J. Wait
Regional Engineer

EXHIBIT I



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

Communicable Disease Center
Atlanta 22, Georgia

Refer to: NEDGB

November 7, 1963

Division Engineer
U. S. Army Engineer Division
New England Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Sir:

It is regretted that there has been a delay in answering Mr. John William Leslie's letter of October 2, 1963, concerning the proposed Hop Brook Reservoir in Connecticut, but I have just returned from a 2-month assignment to Puerto Rico.

It is noted that present plans provide for a permanent pool with an area of 21 acres at elevation 310 feet, m.s.l.; and clearing the reservoir to elevation 313 will be effected.

Although our report pertaining to vector control for the Housatonic River Flood Control Projects is somewhat outdated (Jan. 30, 1957), the basic principles and recommendations still pertain.

It is not envisioned that major vector problems will be created by this project. The clearing specifications are satisfactory. If unanticipated vector problems should arise, technical assistance may be requested from the Connecticut State Department of Health and this office.

We appreciate the opportunity to review the project plans.

Sincerely yours,

Leslie D. Beadle
Chief Biologist
Water Resources Activities

EXHIBIT 2-1

PRELIMINARY EVALUATION REPORT ON VECTOR PROBLEMS
RELATED TO PROPOSED HOUSATONIC RIVER
FLOOD CONTROL PROJECTS IN CONNECTICUT

Inclosure to letter dated January 30, 1957 from
Department of Health, Education, and Welfare, Public
Health Service, Region II, New York, N. Y.

VECTOR-BORNE DISEASE AND VECTOR PROBLEMS

Malaria

Malaria is not known to be of public health importance in Connecticut. The malaria mosquito (Anopheles quadrimaculatus) occurs throughout the State, but normally it is not very abundant. This species frequently breeds in impoundments that contain vegetation or flottage.

Encephalitis

No human cases of Eastern equine encephalitis have ever been confirmed in the State. Horse cases have been uncommon in Connecticut, but outbreaks among captive pheasants occurred in 1938, 1951, 1953, 1955, and 1956.

It is noteworthy that a severe outbreak of Eastern equine encephalitis occurred in nearby Massachusetts during 1956. This outbreak involved 16 human cases (mostly children), 41 horse cases, and 12 pheasant farms.

The mosquito Culiseta melanura is strongly suspected as transmitter of the encephalitis virus to the pheasant. The larvae of this species are usually found in shaded small pools of acid water (bogs).

At present, the transmitter of the Eastern equine encephalitis virus to man and horses is unknown, but salt-marsh mosquitoes

(Aedes sollicitans) and floodwater mosquitoes (Aedes vexans) are strongly suspect.

Aedes Mosquitoes

The principal insects of public health importance in the reservoir areas are Aedes mosquitoes. These insects, which cause severe annoyance to humans and domestic animals, include the following groups: (1) woodland species (e.g. Aedes intrudens) that develop in temporary grassy or leafy pools during early spring, and (2) floodwater mosquitoes, especially Aedes vexans, which breed in temporary pools throughout the spring and summer.

ANTICIPATED EFFECTS OF THE PROJECTS UPON VECTOR PRODUCTION

The overall effects of the projects should be beneficial from a mosquito control standpoint since many swampy areas would be inundated and flooding in downstream areas would be diminished. The latter condition would result in a decrease in production of the highly annoying floodwater mosquitoes.

Mosquito problems that might be created as a result of the projects include the following: (1) malaria mosquito producing areas in quiet, shallow water containing vegetation and/or flottage, and (2) floodwater mosquito producing areas during high flood crests in the spring or summer.

RECOMMENDATIONS

In order to avoid the creation of vector mosquito problems, the following basic principles should be adhered to by the Corps of Engineers in the development of more detailed plans for the design, construction, and operation of the projects.

1. Clear the reservoir sites of trees and brush. (The reservoir clearing plans should have the approval of the Connecticut State Department of Health and the Public Health Service).

2. Locate borrow pits, if possible, where they will be permanently inundated.

3. Provide drainage ditches for the elimination of seepage areas and similar types of ponded water.

4. Remove flotage, secondary growth, and/or aquatic plants as necessary after impoundment.

5. Provide in the maintenance program for regular and frequent field surveys to determine the amount of mosquito breeding.

6. Provide for chemical measures to control excessive production of mosquitoes, especially during periods of high flood crests.

It is further recommended that the Corps of Engineers keep the Connecticut State Department of Health and the Public Health Service currently advised regarding project construction schedules

so that guidance, consultation, and specific recommendations may be provided with regard to vector problems associated with these projects.

Bureau of Sanitary Engineering
Connecticut State Department
of Health
Hartford, Connecticut

Logan Field Station Section
Technology Branch
Communicable Disease Center
U.S. Public Health Service
Atlanta, Georgia



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
59 TEMPLE PLACE
BOSTON, MASSACHUSETTS

November 27, 1963

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Sir:

Mr. Leslie's letter of October 2, 1963 on Hop Brook Dam and Reservoir, Connecticut, included a number of changes in project specifications and indicated that the project has been authorized by the Flood Control Act of July 1960, House Document No. 372, 86th Congress, 2nd Session. He requested that we review our previous report in relation to the change in project plans.

The project changes, except for the land-taking plans, will have insignificant effects on fish and wildlife aspects considered in our prior report. The application of the new land-taking policy to this project improves fish and wildlife aspects of the project and makes our recommendation (number 7) in our report of April 25, 1960, pertaining to flowage easements, inapplicable since all lands will be taken in fee.

We understand that you expect the General Design Memorandum will be completed in November 1963.

At the appropriate time, personnel of the Connecticut State Board of Fisheries and Game and this Bureau will wish to meet with you to--

1. Discuss the most feasible means of minimizing damages to fish and wildlife habitat as a result of construction operations. These discussions and the preparation of a special problems report should precede the development of construction details and the preparation of contract specifications.

2. Develop a General Plan for fish and wildlife management as recommended in our April 25, 1960 report. Negotiations for the General Plan would include consideration of managing project lands as part of the

EXHIBIT 3-1

Naugatuck Regulated Shooting Area and consideration of fishery management requirements including possible continuous flow releases through the gates at the bottom of the outlet structure.

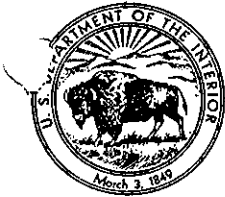
3. Develop specific plans for a boat-launching ramp and associated parking area.

We appreciate this opportunity to review your modified project plans.

Sincerely yours,

A handwritten signature in cursive script, reading "Ennio Abbiati".

Ennio Abbiati, Acting Chief
Division of Technical Services



ADDRESS ONLY THE
REGIONAL DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
59 TEMPLE PLACE
BOSTON, MASSACHUSETTS

NORTHEAST REGION
(REGION 5)
MAINE
NEW HAMPSHIRE
NEW YORK
VERMONT
PENNSYLVANIA
MASSACHUSETTS
NEW JERSEY
RHODE ISLAND
DELAWARE
CONNECTICUT
WEST VIRGINIA

April 25, 1960

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts

Dear Sir:

This letter constitutes our report on the fish and wildlife aspects of 4 proposed flood control reservoirs on the Naugatuck River in Litchfield and New Haven Counties, Connecticut. These sites include Black Rock, Hancock Brook, Hop Brook and Northfield Brook, none of which have been authorized. This report has been reviewed by the Connecticut State Board of Fisheries and Game. The report, and specifically the recommendations which follow, have been endorsed by the Connecticut State Board of Fisheries and Game as indicated in the letter to me dated March 17, 1960, from Director Lyle M. Thorpe of that Board, a copy of which is appended.

Comments were previously submitted concerning these and other sites in our letters of December 14, 1956, and May 22, 1958.

The 4 projects under consideration are located on tributaries to the Naugatuck River, in the Housatonic River Basin. The tributaries enter the Naugatuck downstream from the Thomaston Dam and Reservoir currently under construction. None of the proposed sites are farther than 9 miles from the city of Waterbury, the largest population center in this highly industrialized and urbanized basin.

DESCRIPTION OF FISH AND WILDLIFE RESOURCES
IN RELATION TO PROJECT PLAN

Hancock Brook Dam and Reservoir

Project Plan

The Hancock Brook Dam site is located in the town of Plymouth 3.4 miles upstream from the confluence of Hancock Brook and the

EXHIBIT 3-3

Naugatuck River. At the spillway crest elevation of 484 feet,^{1/} the flood pool will have a surface area of about 265 acres. The dam will be 50 feet high, 615 feet long and will store 3,820 acre-feet of water. The 5-year flood pool at elevation 475 feet will have a surface area of approximately 200 acres. The dam will be provided with a 48-inch ungated conduit. The surcharge elevation will be 10 feet above the spillway.

Fish and Wildlife Resources (Without the Project)

Hancock Brook is an important local trout stream. The State Board of Fisheries and Game stocks this stream annually with large numbers of trout. In 1959 a total of 1,450 yearling, and 25 2-year-old brook trout, 500 2-year-old brown trout, and 75 2-year-old rainbow trout were stocked. This fishery resource provides about 3,000 angler-days of recreation every year.

The reservoir area differs from the other 3 projects in that it encompasses a large area of brushy swampland. Almost the entire area offers good to excellent habitat for cottontail rabbit and pheasant. Lesser amounts of habitat are available for waterfowl, grouse, woodcock, squirrel, mink and muskrat. The State regularly stocks pheasant in the site and in 1959, 125 adult birds were released. About 2,000 hunter days are expended in harvesting the stocked pheasants and the other resident and migratory game species.

Fish and Wildlife Resources (With the Project)

Periodic flooding within the reservoir area will inundate long reaches of streams within the site due to the low gradient of the basin. Over 2.8 miles of Hancock and Todd Hollow Brooks will be inundated whenever the reservoir reaches the spillway crest elevation. Every year a total of about 2 miles of streams will be inundated and 2.4 miles will be inundated every 5 years. It is expected that the trout habitat within the stream mileage annually inundated will be depreciated considerably in value. Streams encompassed in flood storage pools to be held at less frequent intervals will suffer less damaging effects. Trout habitat below the dam site will suffer some temporary damages from siltation during project construction.

The anticipated annual flood pool will inundate about 130 acres of good small game habitat. Every 5 years, about 200 acres will be inundated and at the spillway crest elevation, about 265 acres will be inundated. Some changes in the vegetative composition

^{1/} All elevations in this report are in feet and refer to mean sea level datum.

resulting from inundation can be expected, but this change will probably be minimal within the 1-year level since existing vegetation is adapted to a certain amount of flooding. Indiscriminate borrow operations would cause more serious losses to the wildlife resource at Hancock Brook than at any of the other reservoir sites.

Northfield Brook Dam and Reservoir

Project Plan

The Northfield Brook Dam site is located 1 mile upstream from the confluence of Northfield Brook and the Naugatuck River in Thomaston. The 118-foot high dam will be approximately 800 feet long and is designed to store 2,430 acre-feet of water. A pool held at spillway crest elevation of 573 feet will have a surface area of about 60 acres. The spillway is designed for a 10-foot surcharge. The 5-year flood pool will have a surface area of about 35 acres at elevation 540. Control of the reservoir will be accomplished by means of a 36-inch ungated conduit.

Fish and Wildlife Resources (Without the Project)

Northfield Brook is a locally important trout stream and receives moderate angling pressure. The stream is stocked annually by the State. In 1959, 150 yearling brook trout were stocked and these were supplemented by some natural reproduction in the stream.

The 60-acre reservoir area provides very limited habitat for small game species, due to present land uses and the proximity to the highway. Hunting pressure on the area is negligible.

Fish and Wildlife Resources (With the Project)

At the spillway crest elevation the reservoir pool will inundate 1.2 miles of Northfield Brook. Every year approximately a $\frac{1}{2}$ mile of stream will be inundated and about 0.6 mile will be inundated every 5 years. Periodic flooding will result in direct losses to the production and utilization of the fishery resource.

Potential wildlife production and utilization with the reservoir area will be detrimentally effected. Changes in vegetative composition can be expected, more notably in the lower most frequently flooded portions of the reservoir, which will influence utilization by wildlife species.

Hop Brook Dam and Reservoir

Project Plan

The Hop Brook dam site is located on Hop Brook in the town of Middlebury about 1.2 miles upstream from the confluence of Hop Brook and the Naugatuck River. A small portion of the reservoir area at the dam site lies within Whittemore Glen State Park.

The proposed dam will be approximately 470 feet long, 82 feet high and will store 6,840 acre-feet of water. The surcharge elevation will be 10 feet above the spillway crest. At spillway crest elevation of 362 feet, the surface area of the flood pool will be about 280 acres. Flows through the 48-inch conduit will be controlled by means of 2-3 X 3 foot hydraulically operated gates. The 5-year flood pool at elevation 342 feet would inundate about 150 acres.

Fish and Wildlife Resources (Without the Project)

Hop Brook is considered a locally important trout stream and is stocked annually. In 1959, the State released 1,400 yearling brook trout, 25 2-year-old brook trout and 150 2-year-old brown trout. It is estimated that the stream provides 2,250 angler-days of recreation annually.

The partly wooded reservoir area provides high quality small game habitat and involves lands where the State Board of Fisheries and Game has hunting agreements with landowners. These occur at the upper part of the reservoir site and form part of the Naugatuck Regulated Shooting Area. Despite some posting against access, the project area provides a total of about 1,220 hunter-days recreational annually, about three quarters of this hunting effort being expended in harvesting rabbit, woodcock, grouse, and squirrel. The remainder is accounted for by hunters seeking pheasant which are stocked by the State.

Fish and Wildlife Resources (With the Project)

The reservoir pool at spillway crest elevation would inundate about 1.6 miles of Hop Brook, 0.8 mile of Wooster Brook and 0.3 mile of Welton Brook. Every year, the flood pool is expected to reach an elevation which will inundate 1.2 miles of Hop Brook and 0.5 mile of Welton and Wooster Brooks. Construction activities, annual flooding, and the permanent pool will eventually cause the loss of some, if not all, of the trout angling opportunities now existing.

Flooding to the spillway crest is expected only infrequently; therefore upper elevation areas, including that part of the Naugatuck Regulated Shooting Area within the site, will be subject to minor effects. Frequent flooding to lower elevations will result in more apparent changes in vegetative cover and use by wildlife. Production of wildlife species will be adversely affected, utilization of habitat will be restricted and hunter utilization of this resource will be limited because of flooding at various seasons of the year. Annually, about 90 acres will be flooded and approximately 150 acres will be inundated every 5 years. State Park lands, where hunting is prohibited, accounts for about 14 acres at the annual flood pool area and 20 acres at the 5-year level.

Black Rock Dam and Reservoir

Project Plan

The dam site for the Black Rock project is located on Branch Brook, 1.8 miles upstream from its confluence with the Naugatuck River in Thomaston. Over 70 percent of the reservoir area will lie within the boundaries of Black Rock State Park. A dam 153 feet high and approximately 1,100 feet long will store 8,860 acre-feet of water. At the spillway crest elevation of 513 feet, the reservoir will have a surface area of 180 acres. The 5-year flood pool will have a surface area of 115 acres at elevation 477. Operation of the dam will be accomplished by means of a 54-inch conduit with 2-3 foot by 4 foot hydraulically operated gates. The spillway is designed for a 15-foot surcharge.

Fish and Wildlife Resources (Without the Project)

Branch Brook is considered an excellent trout stream. The Fish Division, of the Connecticut State Board of Fisheries and Game, is using sections of this stream as a study area. In 1959 the stream was stocked with 575 yearling brook trout and 200 2-year-old brown trout. Natural brown trout reproduction provides additional fish for the angler. The fishery resource provides approximately 1,500 angler-days of recreation annually.

Hunting is prohibited in Black Rock State Park, and since the major portion of the reservoir area is State Park land the very small acreage open to hunting receives light pressure. The greater part of the reservoir area is forested and provides good habitat for grouse, squirrels and rabbit.

Fish and Wildlife Resources (With the Project)

At the spillway crest elevation the reservoir will inundate 1.3 miles of Branch Brook. Slightly over a mile of stream will be inundated by the annual flood pool which will be 74 feet deep at the dam. Periodic inundation will result in losses to the stream fishery through siltation, and prevention of angling for short periods of time during and after the flooding period.

DISCUSSION

The Naugatuck River Basin has a population greater than 215,200, of which 90 percent live in urbanized areas of the 5 cities and 28 towns. As an indication of the demands placed on the fish and wildlife resources of the project area, the number of licensed sportsmen within a 10-mile radius of each site averages about 15,000, expending about 77,000 man-days afield annually. Under existing conditions, the project areas meet about 3 percent of this demand, with

the Hop Brook and Hancock Brook areas bearing the greater share of use. If recommendations contained in this report are followed, it is expected that the reservoir areas will be able to meet the maximum possible share of the local demand.

It is understood that the planning agency is recommending the inclusion of permanent pools at each site. At Hancock Brook, a permanent pool at elevation 460 would provide a surface area of 54 acres 6 feet deep at the dam. A large portion of this pool would be less than 3 feet deep. A permanent pool at Northfield Brook would be held at elevation 497 and have a surface area of 7.5 acres 25 feet deep at the dam. At Hop Brook, a permanent pool at elevation 310 would have a surface area of 25 acres and be 14 feet deep at the dam. At elevation 420, a permanent pool at Black Rock would be 36 feet deep at the dam and have a surface area of 15 acres. Reservoir clearing operations will be conducted within the maximum permanent pool level at the 4 sites.

Provision for control of water levels and for drawdown at each permanent pool are important to the management of the fish and wildlife resources. Stop-log type structures appear to be most desirable, and should control the entire elevation of the permanent pools at Hancock Brook and Hop Brook. Control of the upper 10-15 feet of the Black Rock pool, and provision for drawdown of the Black Rock and Northfield Brook permanent pools will be satisfactory. The permanent pools will be managed in a manner not inconsistent with authorized project purposes and the possibility exists that the pools may be drawn down at times for indefinite periods.

Provisions for the inclusion of permanent pools at each of these 4 reservoir sites with water control structures will adequately mitigate fish and wildlife losses resulting from project construction. In addition, it is felt that the measures discussed in the following paragraphs will create further fish and wildlife benefits at no more than incidental cost to the project.

The Hancock Brook site appears to have high potential value as a fish and wildlife management area. The State Board of Fisheries and Game desires that a General Plan for the conservation and development of fish and wildlife resources be executed for this reservoir area. They feel that the best present use of the Hancock Brook reservoir will be to develop it as a small game public hunting area under an intensive management plan. This plan will be geared primarily to developing the most effective pheasant management program, although benefits will accrue to other game species as well. Pheasant stocking, as a management feature, will be employed in a manner best suited to habitat conditions and hunter pressure. Modification of habitat, including that which provides wildlife food as well as cover, will be undertaken in order to adapt the area to best fit into this intensive type management plan. Under a wildlife

management plan, it is anticipated that the permanent pool will be held only periodically for management purposes such as control of vegetation, and so long as the downstream area of Hancock Brook maintains its value for trout.

Those portions of existing roads within the project sites and the railroad bed at the Hancock Brook site, will be valuable for future public access to the reservoir areas and permanent pools. While it is realized that some deterioration of these roads is inevitable during project construction, this deterioration should be minimized as much as possible.

A public access to the pool at the Hop Brook site appears feasible where Route 63 will enter the upper end of the pool. The point where Litchfield Street will enter the upper end of the permanent pool at the Northfield Brook site appears to be the most feasible location for a public access and boat launching point. It is understood that the Corps of Engineers will provide public access, including boat launching and vehicle parking facilities, at these 4 reservoir areas. Therefore, specific provisions for public access have not been made the subject of a recommendation.

Since all of the reservoir sites are small, construction activities and borrow operations will be more or less concentrated. Destruction of the existing vegetation along extensive portions of stream banks will increase damages to existing fisheries. Discharges of large quantities of mud and silt into the streams during construction will damage downstream fisheries values. It is realized that it is impossible to prevent silting of streams during construction operations, without involving additional costs. However, in order to minimize damages to fish and wildlife resources during construction it is recommended that representatives of this office and the State Board of Fisheries and Game be consulted at the time contract specifications are drawn up. It may be possible for fish and wildlife personnel to suggest at this time, means for reducing damages as a procedure in assuring that the reservoir area is left in as good a condition as possible for public use following construction.

The State Board of Fisheries and Game considers the expansion of lands for public hunting and fishing a key endeavor in its overall program. The State Board of Fisheries and Game desires to make an attempt to obtain hunting and fishing rights on lands upon which the construction agency will take flowage easements at the Hop Brook, Northfield Brook and Hancock Brook sites. The best means of accomplishing this appears to be through close coordination with the construction agency when that agency takes the flowage easements. This would mean that a State representative would negotiate for hunting and fishing rights at the same time as a representative of the construction agency is taking flowage easements.

Continuance of the existing commercial sand and gravel operations within the Hancock Brook reservoir site would be detrimental to fish and wildlife management of the reservoir area. Elimination of stream silting from this operation would improve the fishery potential of the stream, and the permanent pool.

RECOMMENDATIONS

We recommend:

1. That provisions be made for permanent pools at each site with approximately the following depths at the dam: Hancock Brook Dam, 6 feet; Northfield Brook Dam, 25 feet; Hop Brook Dam, 14 feet; and Black Rock Dam, 36 feet.

2. That permanent pool water control structures provide for the following: control of the entire pool elevation at Hancock Brook Dam and Hop Brook Dam; drawdown of the pool at the Northfield Brook Dam; and control of the upper 10-15 feet and drawdown at the Black Rock Dam.

3. That Federal lands and included water areas within the Hancock Brook project area, be made available to the Connecticut State Board of Fisheries and Game in accordance with a General Plan for wildlife management as provided in Sections 3 and 4 of the Fish and Wildlife Coordination Act, except for such portions as may be reserved by the construction agency for reasons of safety, efficient operation or protection of public property.

4. That insofar as possible the following roads and railroad bed within reservoir boundaries be preserved for public access purposes: Hancock Brook Dam, Todd Hollow Road, Waterbury Road and the bed of the New York-New Haven Railroad; Northfield Brook Dam, Litchfield Street; Hop Brook Dam, Routes 63, 188, and Bristol Street; and Black Rock Dam, Route 109 and Northfield Street.

5. That, insofar as possible, deposition of sediment in streams be minimized and existing streamside vegetation be maintained within 50 feet of stream banks at all sites except within permanent pool areas.

6. That representatives of the Connecticut State Board of Fisheries and Game and this office be consulted at the time contract specifications are drawn up to consider the most feasible means of minimizing damages to fish and wildlife habitat as a result of construction operations.

7. That the taking of flowage easements by the construction agency be coordinated with the anticipated taking of public fishing and hunting easements by the State at the Hop Brook, Northfield

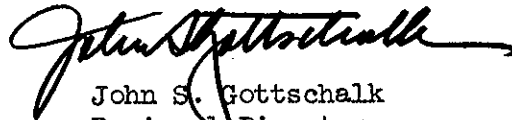
Brook, and Hancock Brook Reservoir sites.

8. That no commercial sand and gravel operations be permitted within lands acquired by the Federal Government at Hancock Brook Reservoir.

9. That additional detailed studies of fish and wildlife resources affected by the project be conducted as necessary during further planning and construction phases of the project to form the basis for such reasonable modifications for the conservation and development of fish and wildlife resources as may be desirable to obtain maximum overall project benefits.

10. That additional modifications to achieve maximum project benefits to be made in project facilities or operations, subsequent to completion of construction, as may be desirable to obtain maximum overall project benefits, on the basis of follow-up studies by this Bureau to improve or supplement measures taken for the conservation and development of fish and wildlife resources, notwithstanding Paragraph (g) Section 2 of the Fish and Wildlife Coordination Act.

Sincerely yours,



John S. Gottschalk
Regional Director

Attachment

C
O
P
Y

STATE OF CONNECTICUT
BOARD OF FISHERIES AND GAME
2 Wethersfield Avenue
Hartford, Connecticut

March 17, 1960

Mr. John S. Gottschalk
Regional Director
Fish and Wildlife Service
59 Temple Place
Boston, Mass.

Dear Mr. Gottschalk:

This Department has completed its review of the draft copies of the fish and wildlife reports pertaining to the Upper Naugatuck River Basin projects and the Hall Meadow Brook Reservoir project.

These reports, including their conclusion and recommendations, have my complete endorsement and we are willing to accept the responsibilities inherent in the execution of a General Plan.

Sincerely yours,

/s/ Lyle M. Thorpe
Director

AL/B



STATE OF CONNECTICUT

WATER RESOURCES COMMISSION

STATE OFFICE BUILDING • HARTFORD 15, CONNECTICUT

February 27, 1964

General Peter C. Hyzer
Division Engineer
Corps of Engineers, U. S. Army
New England Division
424 Trapelo Road
Waltham 54, Massachusetts

Re: Hop Brook Flood Control Reservoir
Water Supply - Stream Encroachment
Lines

Dear General Hyzer:

This will refer to your requests seeking the views of this Commission concerning the inclusion of water supply storage in the proposed flood control reservoir and the establishment of channel encroachment lines on the stream below the dam.

Water Supply

Our inquiries concerning the probable need of storage in this reservoir for public water supply and industrial water supply purposes lead to the conclusion that there was only one possible need. The Naugatuck Division of the Connecticut Water Company indicated an interest and desired an opportunity to give more detailed consideration to this matter. I am informed that direct correspondence between the water company and your office covers this matter. There were no other indications of storage in this reservoir for any other purposes.

Channel Encroachment Lines

Although the establishment of channel encroachment lines along the stream below this dam is not on our immediate program we can assure you that these lines will be established prior to or by the time the dam is constructed. We will plan to carry the establishment of these lines on with the establishment of the lines below the Northfield Brook Dam and the Hancock Brook Dam.

Very truly yours,

A handwritten signature in cursive script, reading "William S. Wise".

William S. Wise
Director

WSW:js

EXHIBIT 4

REGION ONE

CONNECTICUT
MAINE
MASSACHUSETTS
NEW HAMPSHIRE
NEW JERSEY
NEW YORK
RHODE ISLAND
VERMONT
PUERTO RICO

U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

248 Farmington Avenue
Hartford 5, Connecticut

May 7, 1963

File: NEDCW

Brig. Gen. Seymour A. Potter
Division Engineer, Corps of Engineers
U. S. Engineer Division, New England
424 Trapelo Road
Waltham 54, Massachusetts

Attention: Mr. John Wm. Leslie
Chief, Engineering Division

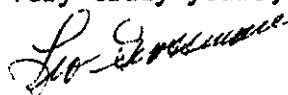
Dear General Potter:

On April 25, 1963 Mr. Leslie, Chief, Engineer Division, Corps of Engineers, New England Division, wrote to this office requesting advice as to whether you could expect certification of the desirability and need for a bridge over the proposed Hop Brook Dam on the Hop Brook in the Towns of Waterbury and Naugatuck, Connecticut.

The location of this dam, as shown on your enclosed reservoir map, has been discussed with the State Highway Department. Its effect on the State and Federal-aid highway systems has also been reviewed by both offices. As a result of this study and review, it has been determined that no public highway bridge is economically desirable or needed on this dam at this time and consequently, no certification may be expected.

As the proposed dam affects a highway on the Federal-aid Secondary System and the reservoir area approaches the Interstate Highway now under construction, we appreciate this opportunity to review the situation presented by your proposed construction.

Very truly yours,



Leo Grossman
Division Engineer